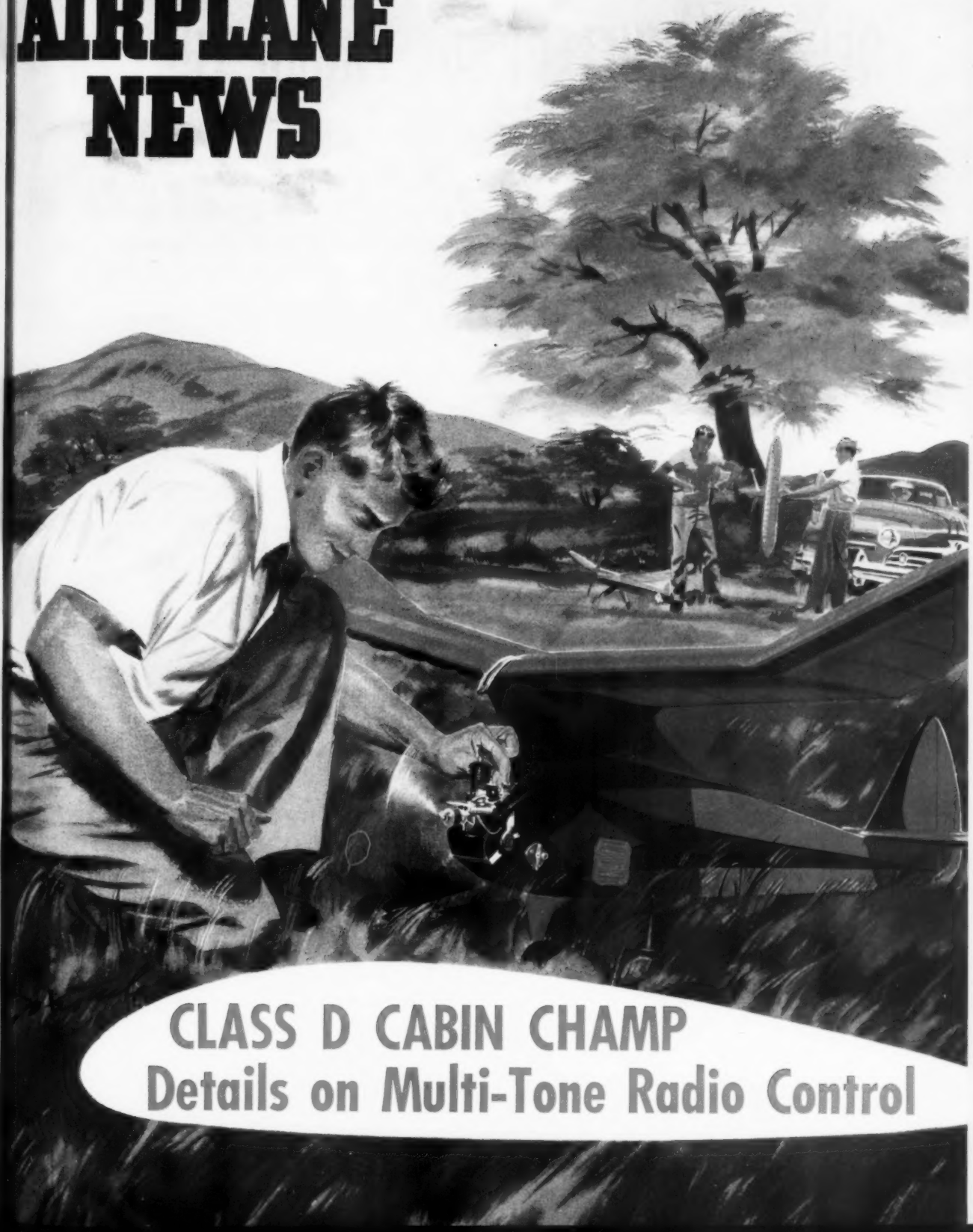
# MODEL AIRPLANE NEWS

AUGUST 1949 • 25 CENTS



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TESTORS

# STA

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By BILL WINTER

ON April 8, the *Aero Modelers Association of Northern California* held a meeting that could well go down in modeling history. The *AMANC* made some decisions on team racing, proto racing, as well as the scale or semi-scale racing picture in general. But before unveiling Northern Cal's handy work we'd like to fill in the background. Rather, we are going to ask one of the Northwest leaders to fill it in for us. How about it, Earl Cayton, of Salem, Oregon? Earl, incidentally, sought out Northwest opinion on our request for readers of M.A.N.

"Most fellows," begins Earl, "are wishing for an AMA standardized set of rules more than any stipulations in the rules. By this, I mean that every club that throws a proto contest is devising its own rules which means that a new plane must be built for every contest entered—very similar to the old days before many clubs belonged to AMA, each organization flew by a different set of rules, and free flight gassies had to be modified from one contest to the next to fit different rules.

"As for several guys flying in the same circle," continues Earl Cayton, "this is okay for team speed but most fellows don't care much about flying in the same circle with strange modelers. Most fellows would like to give scale jobs entered a decent break. If a man enters a scale job in proto, the engine head should not be required to be cowled in if the scale design does not lend itself readily to complete cowling—in this case only the crankcase should be required to be fully cowled. Otherwise, F.A.S.T. seems to have a good set of rules for a starter. New ideas will creep in as the fellows do more proto flying."

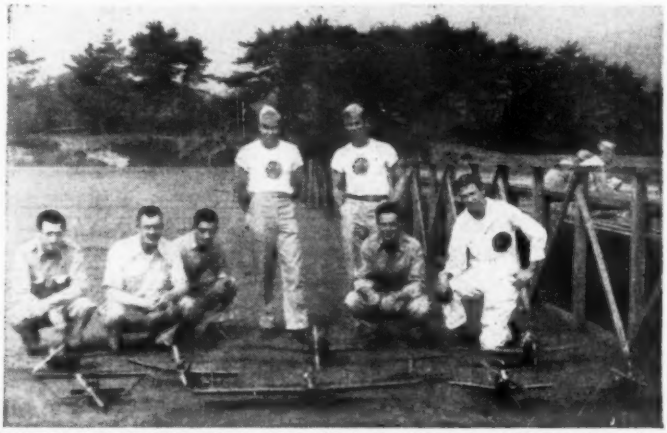
Well put, Earl! It is quite true that the national picture is very much confused because of the sudden spurt in popularity in the realistic U-control airplane which, after all, is the core of this business of team racing and/or all the other associated ideas. We must keep our eye on the inescapable fact that the ship with eye appeal ties in with the greatest basic appeal of the hobby to youngsters, beginners, and many oldsters. In some sections, semi-scale and/or proto jobs are being flown against time, in others 180-laps is the thing; in still others they are raced in separate circles simultaneously. The variations are infinite. And while a committee was rushed into being to devise standard rules by Nationals time, it is from the ideas popping up all over the nation that the rules will be finally extracted. So Northern Cal's rules could well prove to have that State's usual effect on the rest of the country's flying. What are these rules?

First of all, they voted to accept the F.A.S.T. rules for team racing with a possible exception of the pilot leaving the circle for starting an engine, that being considered a possible danger. But they also acknowledge the important interest in proto speed. These models, thinks the *AMANC*, should be flown two ways: one, according to F.A.S.T. rules; two, against time in all engine classes. Note that all engine classes. It was felt, incidentally, that proto racing under F.A.S.T. rules might supplant the current 180-lap wing-dings.

For proto speed against time, these rules were set up: four engine classes, as in present speed; resemblance to full-scale ship, with fixed or retractable gear, but must land and take-off on own gear; lines sizes .010 for A, .012 for B, .014 for C, and .016 for D, and a 20G pull test for all; clocking to take place from standing start for 24 laps. One rule, important and new enough to be highlighted on its own, is the one governing plane sizes according to engine classes. The AMA of Northern Cal. decided to fix this by spans, (areas being too much of a nuisance in processing) with 36" for D, 30" for C, 24" for B, and 18" for A. Well, men, the fat is in the fire. Guys who want to use all size engines have their foot in the door. Fans of the scale or proto model have made their voice heard. Looks to us as if the good looking airplane has worlds of possibilities. It should be pointed out that these rules so far belong to one section; national rules have not yet been written.

Eddie Cosh, editor of MODEL AIRCRAFT, the Journal of the S.M.A.E., has been telling us about a remarkable hobby show put on each year in London. It seems that the publisher of MODEL AIRCRAFT also puts out the MODEL ENGINEER, a weekly magazine now over 50 years old! Since 1908 this firm has

(*Turn to page 8*)



**Thanks to Sgt. R. Tindall for this pic of *Itamihawks Model Club*, Itami Air Force Base, Japan**


# MODEL AIRPLANE NEWS

*Serving Aviation 21 Years*

AUGUST 1949 VOL. XLI—NO. 2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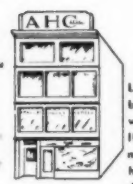

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| Arden Glo (V2 or V3) - .65 & | .85 |
| Ohlsson Glo (V or V2) | .65 |
| Champion Glo V.V2.V3 | .75 |
| McCoy Hot Point | .85 |
| Gauge set for Sparkplugs | .15 |
| Glo Plug V or V2 | .39 |

| | |
|---|---|
| 6 ft. Rook-up wire | .25 |
| Alligator clips | .10 |
| End Clips, 2 for | .10 |
| Tip Jacks(set) for boosters | .60 |
| Arden Booster Jack | 2.25 |
| Austin Booster Plug-in | .30 |
| Copper Lugs, 12 for | .25 |
| Midget Switch slide -30aTurn. | .50 |
| Terminal Clips, 2 for | .05 |
| Arden Battery Cord kit | .35 |

| | |
|---|---|
| 5/8"-.20c, 11/16"-.25c.1-1/4 | .45 |
| 1¼"-.85c.1-3/4"-.90c, 2" | .95 |
| 2¼" or 2½" - 1.00, 2¾" | 1.25 |
| 3"Needle Nose 1¾"dia. 2" | 1.15 1.20 |
| Adapter Nuts (state eng.) | .20 |
| Plastic 1¼" | .50 |

| | |
|---|---|
| Poly-arc Streamlined (pr)1¼" | .45 |
| 2" - 50c, 2½" | .75 |
| Pneumatic (pr) 2¾" - | 1.50 |
| 3½" - 3.00, 4¾" | 3.50 |
| Semi Pneumatic(pr) 3" | .85 |
| 3½" - 1.00, 4" | 1.50 |
| Sponge Rubber, Burnl hub (pr) | |
| 7/8"-.25c.1-1/8"-.30c.1-3/8" | .30 |
| 1-7/8" - .45c, 2-3/8" | .90 |
| Sponge Rubber Wheels Hub (pr) | |
| 2"-40c, 2½"-50c, 3½" | .60 |
| Trailer Pneu.(pr) 3½" or 4½"-.40 | |
| 1¼",2"-50c,2½",2½"-60c,2¾"1.00 | |
| 3"-1.25,3½"-1.50, 4½" | 1.75 |
| Tail Wheels 7/8"-10c; 1-1/8"-15c | |
| Sparky Tail Wheel Assembly | .25 |
| Metal, side by side, penlite | .40 |
| medium - 40c, regular | .50 |
| 4-pencell | .60 |
| Plastic, end-to-end pen. med. | .40 |
| Plastic, for 6 penlites | 1.25 |
| Paper | .25 |

| | |
|---|---|
| Austin metal | 3.50 |
| Hillcrest plastic | 1.25 |
| Arden plastic | 0.85 |
| Stutter-off Valve | .75 |

| | |
|---|---|
| No. 70 oil.3 oz.-25c, pint | .60 |
| Presto Disc Starter | .25 |
| Coil Holder | .15 |
| 'Spanst' Starter | 5.00 |
| Metal Pump Can 75c & | 1.50 |
| Tiger Fuel Pump | .60 |
| Fuel Line Filter | .35 |
| Motor Cover | .25 |
| Elgin Stop Watch | 12.50 |
| Midget Screw Driver | .10 |
| Metal Motor Mounts.Sm-30c Lg. | .50 |

| | |
|---|---|
| .006,.008,.010,.012,.014,.020 dia. 2-52' lines | .50 |
| .010,.012,.014,.016,.018, .020 dia. 2-70' lines | .60 |
| BERKELEY control lines | |
| .008,.011,.014 2-70' | .65 |
| 2-150' | 1.00 |
| Stranded .015,.021, 55'-75'; 70' 1.00.100' 1.95, 200' | 2.75 |
| U-Reely Contr.-7.50.cable | 8.50 |
| U-Reely Remote | 12.50 |
| Jen Contr. Handle(pistol grip) | 2.50 |


**3 Ready-to-run Leaders**

FREE PREMIUMS INCLUDED

THOR B $9.95

Everything you want in your engine A REAL POWER PLANT IT .29 displ., 1/6 horsepower, weight 4 ounces. Class B

IN KIT FORM $6.95

GENIE 29 $6.95

BOYS! Here is the engine you've always wanted. An engine that's been acclaimed the "easiest starting gas engine"! .29 displ., 1/6 horsepower, weight 4 ozs., Class B. Good for glo-plug.

RAM $6.75

With features that step-up power, give longer life with lighter weight Class B, .292 displ., 1/6 h.p. 6800 rpm. weight 4½ ozs.

DUAL RAM INCL. GLO PLUG $6.95


| | | |
|---|---|---|
| Neoprene Tubing, per foot. | | .30 |
| Transparent | | .15 |
| Gasket Paper | | .25 |
| Plug Wrench,3-way-15c;4-way | | .25 |
| Socket Plug Wrench,4-way | | .50 |
| Universal Needle Valve | | .50 |
| Flexible | | .75 |
| Needle Valve Exten.Flexible | | .35 |
| Log Book | | .10 |
| Extension Shaft 4½" | | 2.00 |
| Bolts & nuts,4",1",1½", 1¾", 2" | | .20 |
| B-E Fuel Shut-off Valve | | 1.00 |
| Plastic Fuselage 19"setof2 | | .50 |
| Tassor (most colors)20"x24" | | .05 |
| Sailkapar light 18"x24"(white) | | .05 |
| heavy 24x30"(white) | | .10 |
| Red,Blue,Yellow 24"x20" | | .10 |
| Silk per yard | | 1.50 |
| Blow Torch | | 3.25 |
| Cement (tubes) | | .10& .25 |
| Wood Stripper | | .25 |
| Landing Gear J-bolts, 4 for | | .25 |
| Landing Gear washers 3/32", 1/8", 12 for | | .05 |
| Plastics Kit | | .15 |
| Fillet Fill | .35 Fill-It | .45 |
| Wheel Collar & Hub, pr. | | .25 |
| Copper Tubing 1/8"OD.per ft. | | 20.00 |
| Brass Tubing 1/16",3/32",1/8" | | .15 |
| Sheet Aluminum(sq.ft.) 919" | | .35 |
| .020"-55c, .032"-75c, .064" | | 1.25 |
| Pipcone(6"x12") 1/32" | | .10 |
| 1/16"-25c,1/8"-30c, 1/4" | | .35 |
| Masking Tape 1/4"x3 ft. | | .10 |
| 3/4"x30 ft. | | .29 |
| Sandpaper, assorted pack. | | .10 |
| Soldering Set | | 2.25 |

## U-CONTROL ACCESSORIES

| | |
|---|---|
| Aristocrat Plastic Handle | .75 |
| FYLON control lines | |
| Flexible 2-52' 1.50;2-70' | 1.95 |

| | |
|---|---|
| Thumb-it Control Handle | 1.98 |
| Control-it Elev.Contr.Unit | 1.95 |
| Wood Control handle | .25 |
| Metal Handles | 1.00&1.25 |
| Steel Control Rod 12.00 & | 1.25 |
| E-Z Plastic Control Handle | .85 |
| Sampler Handle & Reel | 1.25 |
| Metal Flight Reel 1.00 & | 1.25 |
| Reel,Handle,Crank kit | 1.25 |
| Stunt Bellcrank & Flev. horn | .25 |
| Veco Bellcrank | .25 |
| Elevator control horn | .25 |
| Hornsthelier.12"-10¢, 4" | .15 |
| Speed Indicator Tables | .10 |
| Elevator hanges 4 for | .10 |
| Swivels, small 15ep; large | .20 |
| Adjustable Push Rod set | .25 |
| Take-off Dolly kit | 1.00 |

## GAS MODEL BOATS

| | |
|---|---|
| Chris-Craft Crusser 36"C-D | 5.50 |
| Owens Yacht 26" B-C-D | 5.50 |
| Marine 25" B-C-D | 5.50 |
| Chris-Craft Runabout 25"BCD | 5.50 |
| Chris-Craft Express 25"BCD | 5.50 |
| Vineyard 25" BCD | 5.50 |
| Dumas Electric Brave Unit for 6 above ships | 4.00 |
| Marine Drive unit for 6 abv. | 2.75 |
| Buckeye prefab. 17" A-B-C | 6.95 |
| "Cabin Crusser 17" ABC | 5.95 |

## THIMBLEDROME & ACCESSORIES

| | |
|---|---|
| Thimbledrome Race Car | 2.95 |
| Champion car ready to run with Con Engine | 21.50 & 19.50 |
| Con.15 or .099 Engine only | 9.95 |
| Con 199 Engine only | 10.95 |


**Scoop! Scoop! Scoop!**

with every purchase of a

PHANTOM P-30 engine at $13.95

You can have, without extra charge, your choice of any U-Control or Free-Flight Kit listed, selling for $5.00 or less. All free items for engine and plane also included.

Glo or Ignition 1/5 hp., .295 displ. Class B. 8,500 rpm.

TOTAL RETAIL VALUE OF $29.45 NOW ONLY $13.95

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The NEW America's Hobby Center giant 2-color 24 page (each 8½" x 11") Summer Catalog # 19 is just off the press! Over 50,000 items that every modeler needs are listed and illustrated. There's a whole page of Pee-Wee engines, planes and accessories, 5 pages of models for gas engines (over 150 U-Control Kits, over 50 Free-Flight models!!, there's a whole page showing all the gas engines, page after page of accessories, supplies, etc., etc. For the non-gas modeler there's gliders, rubber jobs, ships and powered boats and ALL the latest race cars, plus special articles on plans and engine selection, flying, wiring, trouble-shooting, control-line tips, launching, etc., etc.

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In order to keep the AHC catalog current, it is completely revised FOUR TIMES PER YEAR . . . so insure inclusion of all the latest in model kits, engines and supplies AT THE LATEST, LOWEST PRICES! Once you order from AHC you get a new catalog FREE with every order, a copy of each latest catalog as it is printed. SEND 10c FOR YOURS TODAY!! If you haven't a dime, send for our FREE catalog.

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# SPECIAL! BARGAIN!

# Complete FLYING OUTFITS

## WORTH TWICE OUR COMBINATION PRICE!

IT ISN'T OFTEN that you get the chance to buy, at less than half price, a U-Control Plane, Engine and All-Accessory Outfit with your own choice of 24 well-known FACTORY ASSEMBLED ignition or glo engine. Everything carries the famous America's Hobby Center guarantee.

Even if you are a beginner, you won't have trouble building and flying any of these flying outfits, full-size plans of an easy to-build and fly plane, every accessory you will need, complete instructions, etc., etc. If you are an old-timer at building and flying model planes we don't have to tell you what these bargain outfits are really worth.

Thousands of these complete units have already been sold. They have met with enthusiastic reception because they represent a value unheard of before in the modeling field. The price is so low that we cannot sell to dealers. You really save from $10 to $12 by buying the complete, packaged unit - everything is engineered by experts for a perfect flying combination.

**Your own choice** of 24 well-known, factory assembled engines, all guaranteed by the manufacturer and America's Hobby Center.

YOUR CHOICE $10.00

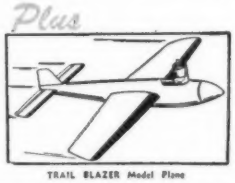
YOUR CHOICE $12.50

YOUR CHOICE $13.50

ARDEN .099 Ball bearing Ign. or glo
OHLSSON 29 Ignition or glo
PHANTOM Ignition or glo
SPORTSMAN 99 Ball bearing & rotary valve
YOUR CHOICE $15.00

Plus

$8.50


TRAIL BLAZER Model Plane

**TRAIL BLAZER** Model Plane with carved lower fuselage-half, fully formed aluminum upper half. Balsa sheet wing, no tissue used. Balsa tail surfaces, plywood engine mount. Schematic drawings with step-by-step plans. Rubber wheels, detail paint schemes.

Plus not 75, not 100 but ALL **ACCESSORIES including:**

●PLUS: Correct size finished propeller ● 3-way plug wrench ● Presto Engine starter with handle and cord ● Speed indicator tables ● Log Book ● Motor cover ● Spark or glo plug with gasket ● Complete engine instructions ● 24 page Gas Engine Theory Manual ● Engine adjustment chart ● Metal fuel tank and gas line ● Metal Battery box ● Wilco Quality Coil ● 12" Hi-tension lead wire and end clips ● 18" insulated ignition wire ● Ignition slide switch ● Coil holder and mount ● Everlast condenser ● SAE = 70 Oil ● 4 ignition wiring lugs ● Spark plug gauge set ● 2 plane identification tags ● 72 Insignias ● 72 page book on Control-liners, How to build and fly them ● Cement ● Sandpaper ● "Pro" all-metal knife and blade ● Metal bellcrank with bolt, nut and washer ● Elevator horn ● Elevator hinges ● Lead-in wire ● Push-rod wire ● U-Control handle ● 100 feet U-Control stainless steel wire and reel ● Membership in Modelcrafters of America ● 24 page giant 2-color catalog ● Postage ● Packing ● Insurance.

Ignition parts not needed with glo engines not included.

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### Complete RACE CAR OUTFITS

COMPLETE OUTFIT AT ABOUT 2/3RDS THE ACTUAL COST IF ITEMS WERE PURCHASED SEPARATELY!!!

Everyone is racing the new Thimbledrome race car, the little 10" model that cannot be beaten for realism, craftsmanship, speed and lasting pleasure. Speeds from 15 to 70 miles per hour. You can race this car in a schoolyard or any small, level space.

THIMBLEDROME RACE CAR

Your new choice

with BUZZ ENGINE only $10.50

with OHLSSON ENGINE only $15.50

Plus all accessories

Your choice of two well-known engines, ready to run ● Glo plug for new, ignitionless engine operation ● Metal fuel tank ● Neoprene gas line ● Complete engine instructions ● Battery connecting wire ● Mounting bolts ● Mounting nuts ● Motor cover ● Pamphlet on glo fuels ● Plug wrench ● Thimbledrome race car complete includes rubber race tires ● Complete instructions for installing and running engine ● Motor mounting bracket ● Flywheel ● Yoke ● Tether cord ● Membership in Modelcrafters of America ● Postage ● Packing ● Insurance ● Full A. H. C. Guaranty ● 24 Page Giant Catalog.

Everything you will need except a 1½ volt battery, fuel and a small file for cutting away parts of the body to install the engine. In addition, mounting and motor shaft holes must be drilled.

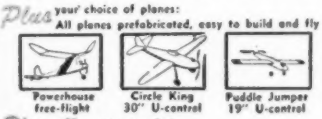
### Scoop! Complete PEE-WEE FLYING OUTFITS

These are the new pint-size glo engines that are so tiny (1 to 1⅞ ounces) but develop plenty of power for free-flight or U-control flying.

Your new choice of 3 of the best, all fully guaranteed:

$7.95 $9.95

Plus your choice of planes: All planes prefabricated, easy to build and fly




Plus all accessories

You get the same accessories listed in our other flying outfits (excluding those not needed in a glo engine, of course). Everything needed to build and fly planes shown except fuel and starting battery.

### Complete CO-2 FLYING OUTFITS

For the younger set, their Fathers and big brothers, there's nothing like the thrill of CO2 flying. You don't need much space for free-flights (100 feet square on windless days), and less than a twenty foot circle for tethered flying.

THERE'S NOTHING TO LEARN AND PLENTY OF FUN!

BUZZ CO2 Engine $6.45 (includes refillable tank, capsule charging unit). Costs only 2c per flight to run. Plus Cavacraft Stinson, Berkeley Profile Powerhouse or 19" Puddle Jumper. Kits are completely precut and shaped, ready to assemble!

O.K. CO2 Engine $6.95 (largest CO2 engine made) with the famous contest-winning 33" Powerhouse kit. (Most CO2 contests during 1948 were won with this matched combination of plane and engine) or 19" Puddle Jumper.

CAMPUS A-100 $7.95 (Smallest CO2 engine made, includes refillable tank). Costs only 1c per flight to run. Choice of Cavacraft Aeronca kit with Cava-Cut parts, completely precut and ready to assemble or the World War I fighter biplane, the S.E.5.

Plus all accessories

CO2 Engine, ready to run ● CO2 Capsule holder ● 2 CO2 Capsules ● Correct propeller ● Complete Engine instructions ● Complete suitable airplane ● Landing gear ● Wheels ● Complete plane plans ● Cement (if needed) ● Flight log ● Insignia ● Identification tags ● Packing ● Postage ● Insurance ● Membership in Modelcrafters of America ● 24 pg. Giant model Catalog ● Full A.H.C. Guarantee.

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# NOW!! BUZZ GLO ENGINES.....

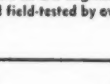
.....have been produced by popular demand! BUZZ Engines have been used in every type of model flying, U-Control, Free-Flight, Radio Control, and now the same high-quality engines are available as Glo-Engines. These engines are the simple, dependable BUZZ engines that in the past year have been time and field-tested by over 20,000 modelers! You'll enjoy more hours of flying per dollar investment with BUZZ Engines!

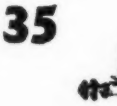
## Rising Costs...

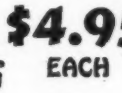
have been offset by the tremendous demand for BUZZ ENGINES. That's the only reason we are able to continue to offer you these Ignition BUZZ Engines at only $4.95! Note we have been able to reduce the price of the "60".....it, too, is only $4.95!

NOW! EACH ENGINE ON THIS PAGE..... $4.95 ASSEMBLED & TESTED

## GLO BUZZ 19, 29 & 35 $4.95 EACH

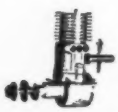






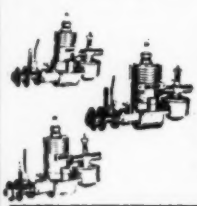
The Interchangeable Class A, B and C Buzz Engines in glo-plug operation! The BUZZ 19, 29 & 35 Engines lead the field in low-cost FLYING FUN! Thousands of modelers all over the world depend on the rugged construction and easy starting of BUZZ Engines every day for their FUN in FLYING. Can be interchanged on the field so you can fly the same model in Class A, B or C.....the crankcase mounting holes are identical.

## GLO BUZZ "60" $4.95



.....for large Class D models in Free-Flight or U-Control or as a simple way to avoid ignition interference for radio-controlled flying! Whenever you have a lot of airplane to haul skyward, use this powerpacked "60". It's the engine that generated power for the field-command radio sets with the Army during the last War. A flip will start it and you'll have continuous, smooth power for every flight.

## The BUZZ 19, 29 & 35 EACH $4.95



Thousands of modelers all over the world have depended on these ruggedly-constructed, easy to start BUZZ A, B & C Engines. They've changed engines on the field and have flown the same model in all three events...not once, but repeatedly, contest after contest. Four screws to change and your plane flies in a different class...the crankcase mounting flanges and screw holes are identical in all three engines.

## THE "GLO-WEE" NEW!

Just as we go to press, the factory superintendent advises us that the new GLO-WEE will be ready for shipment by the time you read this. Completely field tested, this new "Pee-Wee" size engine is ready to haul any of the new 18 to 24 inch span models skyward. Its steel piston and cylinder are power-packed. You'll have many hours of fun with this economical engine.....not only is the original price low, but the fuel consumption is practically microscopic! You can fly to your heart's content on a can of glo fuel.

## BUZZ CO2 ONLY $4.95

The BUZZ CO-2 Engine is the first 5/16" bore & stroke engine on the market. Thousands have been sold and thousands of modelers have enjoyed the dependable power and economical operation of this intermediate-size engine. The refillable tank allows five flights per CO-2 Cannister.....less than 2c per flight! Engine is complete with refillable tank connected to engine and a capsule tank-charging unit that is die-cast.

## ONLY $4.95

## Use the BUZZ "60"

For the same dependable, easy starting smooth power that thousands of modelers have been enjoying since this engine was first offered a year ago. This is the engine that powered field-command radio sets during the last War.

Use the Buzz 60 for your large Class D Free-Flight or Controline model. Each engine is factory tested and will provide you with smooth, dependable power that will avoid crash-ups and disappointments in contest or sport flying.

NOW! $4.95

## Some facts about BUZZ Engines.....

**SPECIFICATIONS:**

| | 19 | 29 | 35 | 60 | CO-2 |
|---|---|---|---|---|---|
| Displ. | .199 | .299 | .359 | .610 | —— |
| Bore | .660 | .812 | .880 | 1.000 | 5/16 |
| Stroke | .562 | .562 | .562 | .777 | 5/16 |
| Horsepower | 1/7 | 1/6 | 1/5 | 1/4 | —— |
| RPM | 7,500 | 8,000 | 8,500 | 9,000 | variable |
| Prop | 8" | 10" | 11" | 12" | 5½ |
| Weight | 4 | 4½ | 4¾ | 9 | ¾ |

The BUZZ Engines are manufactured by a company that for years has been the world's largest maker of automobile replacement pistons and other precision gasoline engine parts. Thousands of gas engines and parts were made during the war by this company for the War Dept. for use in walkie-talkies, field generating sets, etc., etc. Since the war, thousands of gas engines have been made for scooters, lawn mower and other industrial uses. When we say unconditionally that the BUZZ engine is well engineered and well constructed will give you plenty of good service, this is no idle boast, but a fact!

## ACCESSORY UNITS

### For IGNITION Engines...only $2.49

Spare Plug & Gasket • Wilco Quality Coil • Hi-Tension Lead Wire & End Clips • Everlast Condenser • Correct Size Finished Propeller • Ignition Slide Switch • 8-Way Plug Wrench • 4 Wiring Lugs • 4 Mounting Bolts & Nuts • Presto Engine Starter, with cord & handle • Spark Plug Gauge Set • Motor Cover • 24 Page Gas Engine Theory Manual • Log Book • Engine Adjustment Chart • I. A. E. No. 70 Oil • Coil Holder and Mount • Metal Fuel Tank • Gas Line • Metal Plastic Battery Box • Insulated Ignition Wire

### For GLO Engines...only $1.49

Glo Plug & Gasket • Insulated Ignition Wire • Correct Size Propeller • 8-Way Plug Wrench • Mounting Bolts & Nuts • Presto Engine Starter, with cord & handle • Motor Cover • Log Book • 24 Page Engine Theory Manual • Fuel Tubulage • Metal Fuel Tank • Gas Line

### For CO-2 Engines...65c

Correct Propeller • Motor Cover • Lubricating Oil • CO2 Cannisters

AT NO INCREASE IN PRICE!

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LATEST MEMBER of the Air Force stable of sonic-speed fighter planes is the Lockheed XF-90, which has joined the Republic XF-91 and the Convair XF-92 in flight test. The XF-90, although a brand-new airplane, has the familiar F-80 lines. The wing is swept back 35°. Power is provided by two Westinghouse 24C turbojet engines developing a total of 6000-lb. thrust. These engines are mounted side-by-side in the fuselage with separate air intakes on either side of the nose and separate jets at the tail. The pilot has a special standardized cockpit in which the landing gear knob is in the shape of a wheel, the flap knob that of a flap, etc. The XF-90 will also have auxiliary rocket motors for high speed power and it is this combination of both turbojet and rocket power that is expected to push this triumvirate of fighters into the supersonic realm. But Air Force has no plans for any new fighter production until the outcome of the present B-36 vs Fighter tests is determined.

FIRST FLIGHT of the Martin *Viking* rocket was successful and the second of ten missiles is now being readied at White Sands Proving Ground. The first rocket went to 51-1/2 mi. altitude and attained a speed of 2250 mph. The pencil-shaped *Viking* is 45′ long and burns a mixture of liquid oxygen and alcohol in a motor that develops 10 tons of thrust for one minute. The rockets are not actually guided missiles but are special test missiles designed for the Office of Naval Research as an improvement in certain essentials over the Nazi V-2. One of these essentials is automatic stabilization in pitch, roll and yaw during the flight.

BRITAIN'S FIRST jet bomber has completed its first test flight. It is the English Electric Company A.1, a twin-jet design strongly resembling our own North American B-45 in lines, although the latter has four jet engines. The A.1 is powered by two Rolls-Royce *Avon* turbojet engines and is claimed to have a top speed of 580 mph and a range of 3000 mi. The craft has a two-man side-by-side crew and the fuselage is circular in cross section. It has a single vertical tail surface and tricycle landing gear. English Electric Company has been in the aviation business since World War I, manufacturing equipment and sub-assemblies.

THE FIRST commercial helicopter airport has been opened in New York. The "Heliport" is on the end of a pier jutting out in the East River from Lower Manhattan and is 161′ long and 60′ wide. In addition to serving as a base for the helicopters of Metropolitan Aviation Corporation, N.Y., the heliport will serve as a downtown landing field for helicopter owners on Long Island and from various other areas nearby. Seven helicopter companies have requested permission to fly helicopter air mail service between New York and various outlying towns in an air mail route similar to that pioneered by Los Angeles Airways.

TYPICAL BRITISH caution in their approach to aircraft design progress is being shown in the introduction of wing sweep on Royal Air Force fighters. Instead of producing a swept-wing fighter from design board, the British have taken two new standard types and added wing sweep. The Hawker P.1052 and the Supermarine 510 are swept-wing versions of the standard fighter planes which have been flying since last fall. The new Supermarine design is an adaptation of the *Attacker* jet fighter and differs from the Hawker in the use of swept tail surfaces also. Both fighters are powered by the Rolls-Royce *Nene* turbojet engine of 5000-lb. static thrust and both are believed capable of speed "at and beyond the speed of sound," according to the British Ministry of Supply.

LOCKHEED IS developing an improved *Constellation*, the model L-949. It will have a longer fuselage to accommodate a 50,000-lb. payload. Tests of a standard model 749 with a 50,000-lb. payload indicate the practicality of the increase. The standard airplane has been flown at a gross weight as high as 137,000 lb. with complete safety and good performance. The 749 has a recently increased certificated gross weight of 107,-000 lb.

REPUBLIC F-84 Thunderjet is the second Air Force jet fighter to be assigned to National Guard squadrons, joining the F-80. About one-half of the existing F-84's will be sent to Air National Guard units, or about 200 of the type. The planes will be released from their present Air Force units as soon as new equipment for these units becomes available, including later versions of the F-84 and the North American F-86 swept-wing fighter, which is already in service with the 1st and 56th Fighter Groups. Latest version of the F-86, the


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XF-93, is scheduled to fly in August. Only the prototype will be built, the production order having been cancelled. The new version has flush air inlets on either side of a pointed nose and will have power plant improvements, presumably more power. Lockheed will deliver its first F-94 all-weather two-man fighter shortly. This is a version of the popular TF-80C jet trainer with special radar equipment mounted in the nose.

THE PERSONAL aircraft that everybody has been awaiting for about 20 years may be here at last, but whether it will be produced in quantity and sold at a price within range of our pocketbooks remains to be seen. The plane is actually an old *Cub* which was so reworked and modified in the process as to be unrecognizable. This new plane is the joint effort of Lynn Bollinger, Harvard professor, and Otto Koppen, M.I.T. professor. It is equipped with slots, flaps, a huge propeller, special engine muffler, castoring landing gear and a radical split rudder. Since it can fly at only 30 mph and operate out of a good-size tennis court, it has been named the *Helioplane* by its inventors. This combination of slow-flying ability, stall-proof characteristics, crosswind landing gear and a quiet power plant means that just about everything desirable in a personal aircraft has now been combined in a single plane. The future of the design is not yet certain since the only interest of its inventors was to "prove it can be done", which they feel they have proved. They are now offering their design to interested lightplane manufacturers, few of whom have expressed more than passing interest. And we wonder what's wrong with the personal flying business!

A NON-RACING pilot has been elected president of the Professional Race Pilots Association, succeeding the late Art Chester, who was killed in his tiny racer near San Diego recently. The new president is "Tony" LeVier, Lockheed chief test pilot and former racing pilot who is now forbidden to fly in races by his employers. LeVier revealed that his group had invested $45,000 in the construction of three *Cosmic Wind* race planes but had already earned $20,000 in prize money and expected the whole investment to be written off by the end of this year.

NAVY CONTINUES to prove that the size of aircraft offers only minor problems in their operation from aircraft carriers, by reducing the take-off of the huge Lockheed P2V *Neptune* to a standard operation. At this writing, the feat has been accomplished about 20 times including dual take-offs. On one of the latter, the two P2V's flew on to Moffett Field, San Francisco, Calif., covering a distance of 3000 mi. from their take-off aboard the *U.S.S. Midway* "somewhere in the Atlantic." Although the flight took only 13 hr., each of the twin-engine patrol planes carried enough fuel for 23 hr. in the air. But range is not much of a problem with the P2V, since it holds the world's distance record of 11,326 mi.!

THE KIND OF story we've been waiting to crop up has finally appeared, although we'll probably be hearing them for the next 20 years. This is a rumor that Lieut. General Adolf Galland and Col. Hans Ulrich Rudel, former Luftwaffe aces, are now working in Argentina as test pilots for jet aircraft produced by the Military Aircraft Factory at Cordoba. What makes the rumor even better is that it says that Professor Kurt Tank, former Focke-Wulf chief designer, is believed to be working at the plant under an assumed name. General Galland, it will be recalled, is the Nazi's highest ranking ace although his exact score ranges somewhere between 200 and 300, according to the report you read.

BELL AIRCRAFT has received an Air Force development and research contract for an investigation of the practicality of a special research airplane with variable-sweep wing. Engineers have long agreed that the most efficient fighter design will require straight wings for subsonic flight and very large sweep angle for high supersonic flight, the sweep depending upon the speed. Bell Aircraft, builders of the X-1 and X-2 expect an X-5 contract.

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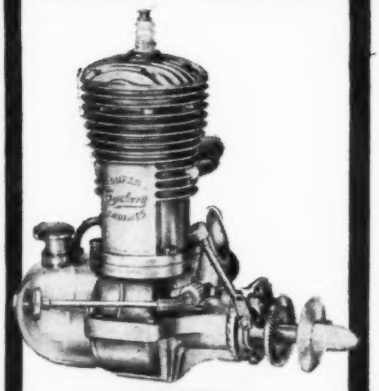

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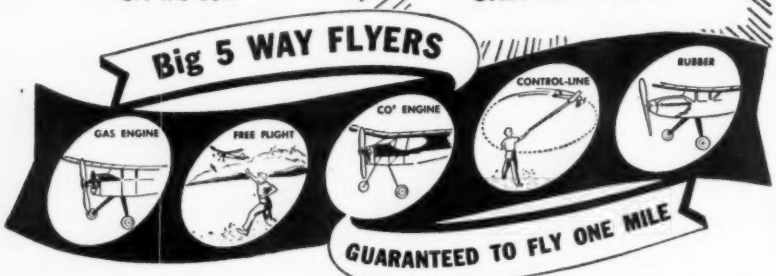


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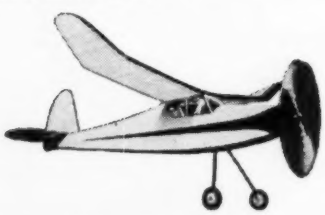

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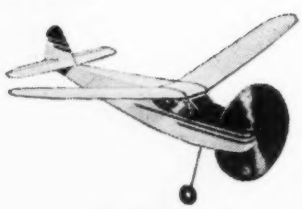

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## SCRAP BOX

(*Continued from page* 1)

been putting on "The Model Engineer" Exhibition. In 1948 over 100,000 paying customers view the exhibits.

Sponsored and financed by the publisher, the show costs approximately $15,000, the outlay being covered by sales of booths to the trade, and tickets to the public. A very popular feature is a large display of models of all types which are entered for prizes by builders all over England. Prizes are cups, tools, kits, but no cash. The latter class of prize, interestingly enough, is not very popular! On the other hand, some of the cups are quite old and therefore keenly fought for. Judging is done with cooperation of the S.M.A.E. who receive somewhat less than $1000 for their services.

A big feature of this show is a 50' dia. track, surrounded by an 8' high fence to protect the crowd. Around the perimeter of this area is a track for race cars and controline stunt models. Inside the track is a water-filled trough for speed boats and sea planes. Despite the small circle, we hear that small diesel-powered stunters do almost everything in the book. Of interest to the trade is the fact that at least one manufacturer managed to book a year's production in orders by these demonstrations.

Despite its huge success, "The Model Engineer" show is badly limited by the confines of the Royal Horticultural Hall where it is held. Thousands of spectators have been turned away and many industry members are unable to purchase display booths. The only hall in London big enough for the modelers' show is Olympia Hall which is booked for three years in advance. The modelers may move over in 1950. (Aside to the Model Industry Association: sounds good, doesn't it?)

It is interesting to watch the approach of big, outside sponsors of new events. Judging by their efforts to encourage ingenuity they don't feel that there is at present much connection between model plane and big plane design, or model and full scale aviation. First, there is the Pan-American weight-lifting event, a very clever, fine event that should build up great interest from season to season. Now the Navy has contributed two highly unorthodox ideas which it is solidly behind as a sponsor. One is for bomb dropping by radio control, with points being given for unassisted take-off distance, accuracy of the dropping of three bombs (by R.C.), and closeness to spot and shortness of landing roll. An arresting device may be used on landing.

Even more unusual is their jet model event for scale or semi-scale types resembling Navy planes. Flown U-control, these ships will operate from a segment of the circle scaled-off to represent a carrier deck. Take-off will be by catapult, and landing will be on the touchdown area at rear of deck, arresting devices being used. The deck is 1/20 scale to a real carrier, as is the catapult and its placement. The ship must fit within scale dimensions of the ship's airplane elevator and hangar, (this probably requiring folding wings that can be operated on the ground). Points will be awarded for slow speed flight (slow-speed high-lift devices, flaps, etc., may be used but must be part of model), high speed flight, and for general efficiency on take-off, landings, and operation from the carrier. The latter includes control after arresting, plus control of the arresting gear, catapult, and so on. Though we give but sketchy detail here, full information presumably will have appeared in the AMA's MODEL AVIATION by the time you read this.

"For the past two years here in the Southwest," tees off Herb Swofford, of the *Cowtown Sahibs*, Fort Worth, "we have been including a combat event in all our contests. It is a tremendous model activity booster and is unequaled for spectator interest which, after all, is what the sponsor

(*Turn to page* 48)

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# REPORT FROM THE WEST

by Lew Mahieu

May 22 was a thrilling day for aviation in Southern California. There was plenty of activity and things of interest to modelers. We managed to take in both the *Thermal Thumbers* Wakefield Contest and the Pacific Air Races on that day.

The first Annual Wakefield Team Competition, sponsored by the Aircraft Chapter of Engineers and Architects Association of Southern California was successfully conducted on May 22 by the *Thermal Thumbers*, under the direction of Tony Pillera. This *EAA-Thermal Thumbers* competition differed from the International Wakefield Event in that each of the five contestants on every team contributed toward the total time for his team. Every member was allowed three flights, making a total of 15 flights per team and the final winning team was determined by the maximum total time. The standard Wakefield rules were adhered to in the competition. Awards consisted of a perpetual trophy and five individual permanent trophies.

There were 60 contestants in 12 teams ready for the competition which was highlighted by team spirit and cooperation of the members of the clubs. Because of this cooperation and enthusiasm, take-offs were made at the rate of one per minute, and 160 out of a possible 180 flights were made. The various team mates really worked together winding, repairing, and retrieving each other's models. On every take-off there were at least five fliers hoping for a successful flight. This sort of competition is really commendable, and it is hoped that the International Wakefield Event can eventually be run upon this basis.

The winning Team C, captained by John Kiener, didn't clinch the meet until the last round when Kiener himself scored a full five-minute flight. He also had the highest free flight total of the whole meet. Team C was handicapped in the first event when Joe Weathers cracked up his model on take-off; then Kiener, who made a five-minute flight in the first round, badly damaged his model upon landing. Rapid repair work, however, enabled him to get back in the competition and help clinch his team's place. The results and teams were as follows: *1st Place*—Team C, Captain John Kiener, *Total Time* 39:31.2; *2nd Place*—Team I, Captain Loren Salisbury, *TT* 32:31.6; *3rd Place*—Team F, Captain Dick Everett, *TT* 32:27.2; *4th Place*—Team E, Captain Bud Hubbard, *TT* 32:14.0; *5th Place*—Team G, Captain Carl Rambo. *TT* 30:01.8; *6th Place*—Team L, Captain Cliff McBaine, *TT* 29:53.0; *7th Place*—Team D, Captain Don Donahue, *TT* 26:46.4; *8th Place*—Team H, Captain Ed Slobod, *TT* 20:28.9; *9th Place*—Team B, Captain Bob Holland, *TT* 14:14.3; *10th Place*—Team K, Captain Russ Johnson, *TT* 13:07.7; *11th Place*—Team J, Captain Byron Bradford, *TT* 12:17.6; and *12th Place*—Team A, Captain David Converse, *TT* 6:58.7. Team A withdrew after first round.

We arrived at the Air Races in Ontario just in time to see Sammy Mason's Hollywood Hawks start their thrilling stunts and daredevil acts. They really put on a show with everything from glider stunting to wing walking and hanging by the knees on an old *Jenny*. Sammy himself put on those daring stunts as only he can, in his "souped up" *Stearman* with a 450 hp engine. He also put on a drunk-pilot show in an Aeronca *Champion*. Bill Odom, round-the-world pilot who recently broke the light plane distance record by flying nonstop from Honolulu to New York, buzzed the field between races. Bill's *Bonanza*, trimmed in red, was equipped with the auxiliary wing tip tanks and all, as if he had just completed his record-breaking flight. Bill Barris and Dick Riedel, flight endurance record holders, flew the "Sunkist Lady" in for the spectators to see. Some 10,000 people watched Bob Downey, flying Fish Salmon's *Minnow*, turn in the highest qualifying time of 187 mph. The first heat race was won by No. 39, Keith Sorenson; Al Foss was second and Earl Ortman, third. The main event was taken by Bob Downey in the *Minnow*. Steve Whitman was second—flying *Bonzo*, and Bill Brennand, third—flying *Buster*.

Team Racing is here to stay; yes, interest is growing rapidly on the West Coast and it seems that every U-Control flier is building or planning to build a team racer. Thanks to Les McBrayer for results of the F.A.S.T. Club's Meet No. 3:

1st—Larry Johnson, 70 pts.; 2nd—Don Rouse, 30 pts.; 3rd—Ormand Sutter, 30 pts.; 4th—Steve Crowe, 24 pts.; 5th—E. S. Hortrauft, 21 pts. The Beauty Event was won by Steve Crowe. By the way, Les himself has a pretty fast Team Racer; it has been clocked at 97 mph. The *Northrop Club* is running Team meets and we hear Don Newberger's K & B job has hit 101 mph.

Mom Robbers always keeps us posted on happenings in Northern California. The

(*Turn to page* 51)

**Winning team at the *EAA-Thermal Thumbers'* Wakefield Meet. Standing are Warren Williams (left) and Andrew Petersen; kneeling—Joe Weathers, John Kiener, Tom Stevens**


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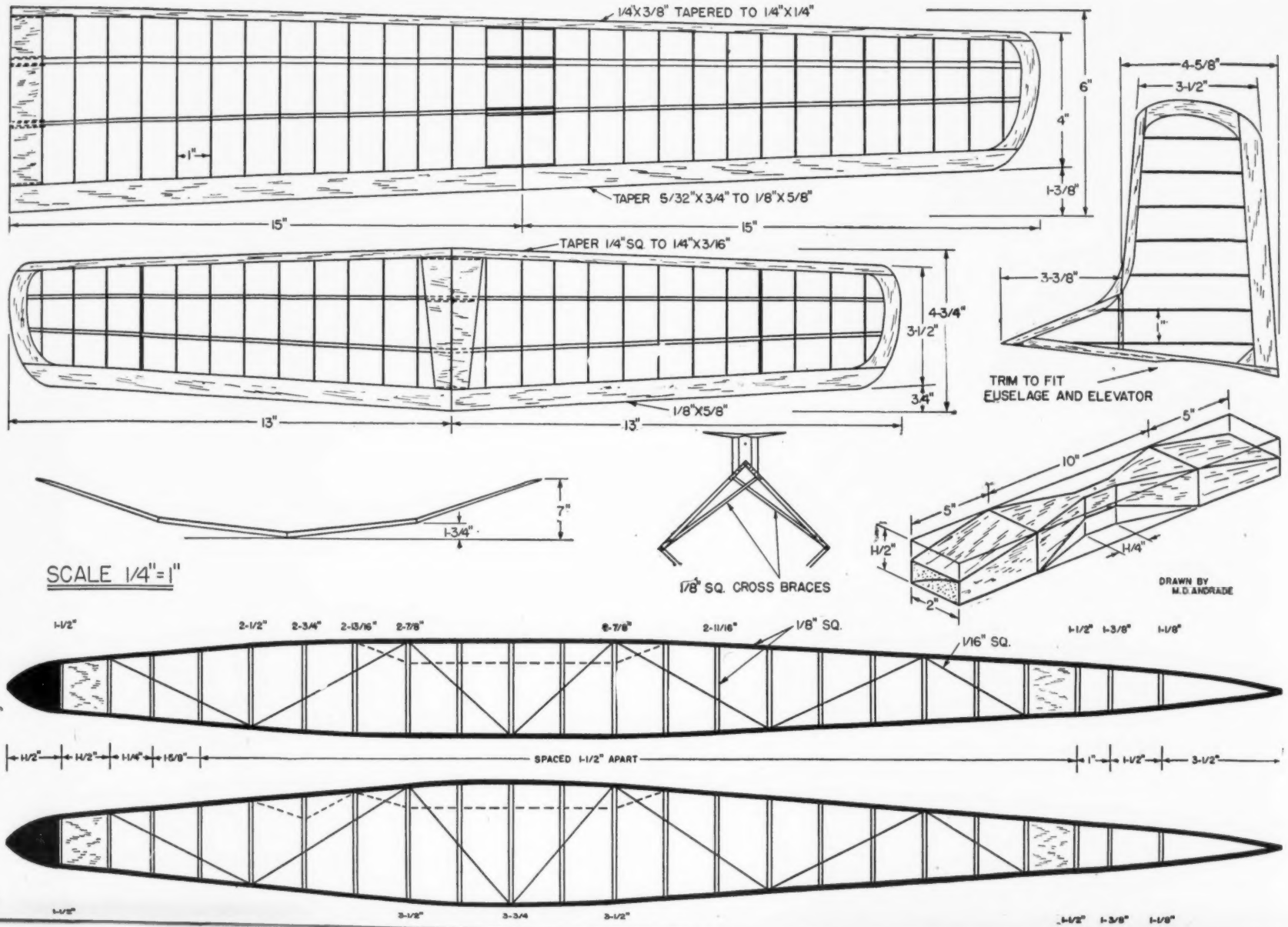
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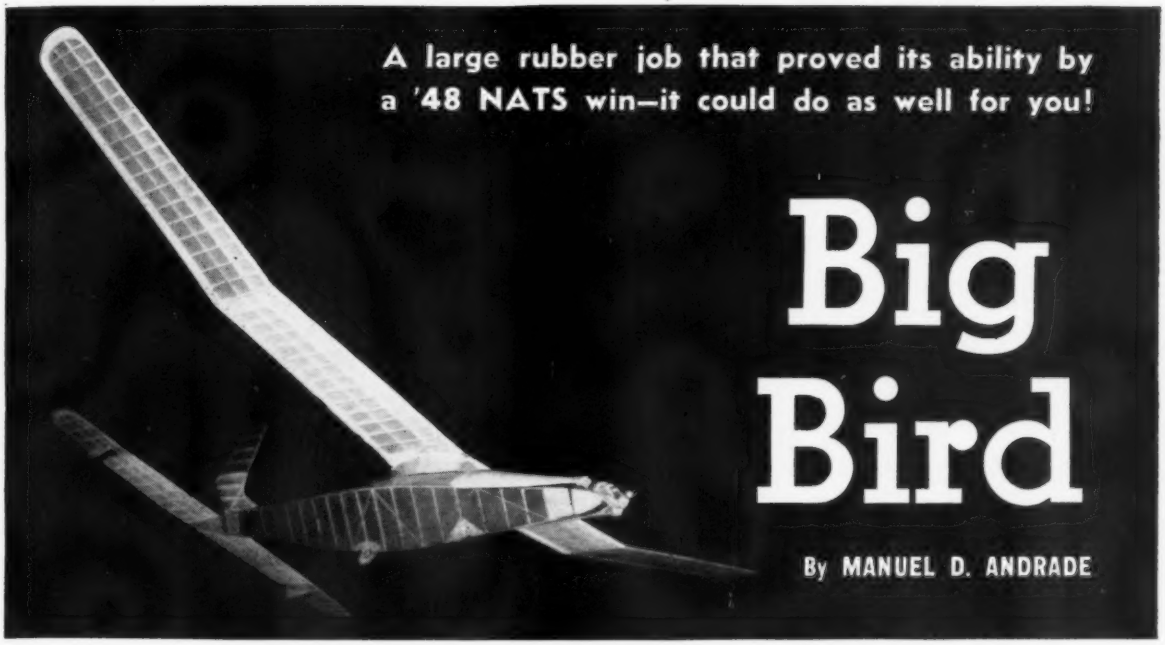
SPACED 1-1/2" APART
1"
1-1/2"
3-1/2"
1-1/2"
3-1/2"
3-3/4
3-1/2"
1-1/2"
1-3/8"
1-1/8"



A large rubber job that proved its ability by a '48 NATS win—it could do as well for you!

# Big Bird

By MANUEL D. ANDRADE

THE history of the design of *Big Bird* began with a 350 sq. in. tow-launched glider. The success of this model at a few meets and the ease of adjusting for various conditions prompted me to try rubber-powering the design. The wing was raised and moved back; 350 sq. in. cabin model and 300 sq. in. stick versions were laid out (the only difference being in the wing span) and construction was rushed for the 1947 Los Angeles All Western Open contest. Although each flight was virtually a test hop, the cabin placed second in its event and the stick set a new National Record of 19:41.9 average in winning in its classification.

The largeness of the two models plus the pivoting slow turns had by this time earned them the title of *Big Bird*.

After losing both models in the early part of 1948, two new models with 300 sq. in. were built. The new cabin model is the one which placed first in the Cabin Event at the 1948 Nationals.

FUSELAGE. The plans are enlarged and two sides are constructed on the side view, one over the other. After the sides are thoroughly dry they are removed from the plans and the remaining uprights glued in. The uprights are then notched on the outside to receive the 1/16 sq. in. cross braces. The general spacing of the cross braces is given in the plans. This style of bracing was used to give the fuselage the rigidity necessary to support a fully wound motor without fuselage distortion. The 1/8" sheet balsa fill-in for the nose, landing gear, wheel and wing position are then added.

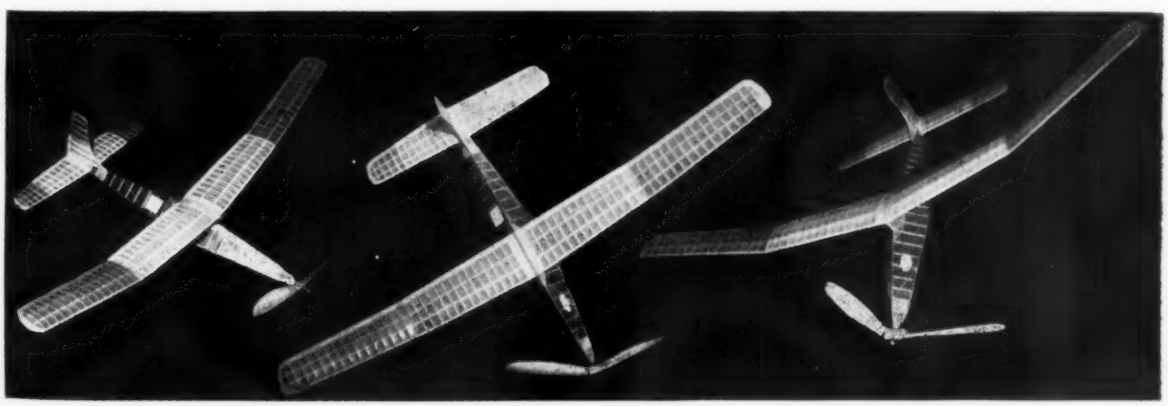
LANDING GEAR. A single strut of 1/16" dia. piano wire was used for the landing gear. Although perhaps a little flexible, it has not been found necessary to change to heavier wire, because of the ship's ability to "jump off."

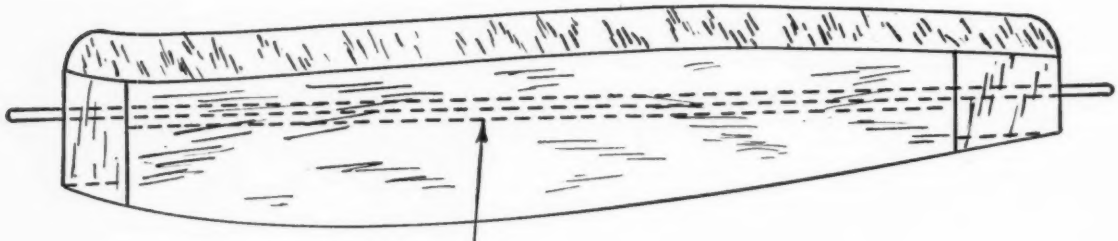
The wire hinge arrangement is first assembled and soldered to the wire strut which has been bent to shape. The two uprights are grooved slightly to receive the hinge arms and a hole is drilled through the lower longeron at the intersection of the uprights. The strut is then slipped down through the hole and the hinge arms glued to the uprights. The hole is enlarged to allow the extension and retraction of the gear. The forward side of the hole acts as a stop in the extended position. A small wire hook, which serves as an anchor for the retraction rubber band, is glued on the longeron between the next forward set of uprights.

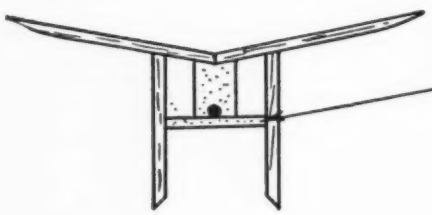
The wheel is made of 1/8" plywood and is sanded to a streamline shape. The wheel is papered and installed using two large washers soldered one on either side, to the axle.

WING. A built-up rib construction was used to keep the wing as smooth as possible. Although this type of construction is a little tedious, the result is well worth the effort. Make sure to use hard 1/16" sheet balsa for the ribs. The sheet stock for the spars, leading edges, and trailing edges should be slightly quarter grained for strength. Using the wing template, the ribs are cut out to the size of the longest rib. They should be 1/16" thick and are trimmed off at the trailing edge to length during the assembling of the wing. The tapered leading and trailing edge are cut from sheet; then blocked up and pinned to the plans. The wing tips are added and then the lower and upper portions of the ribs are glued in. The three dihedral ribs are solid and so are not installed until after the spars have been placed. After the glue is thoroughly dry, the wing dihedral is glued in, using 1/16" sheet balsa gussets. First glue the outer wing panel to the

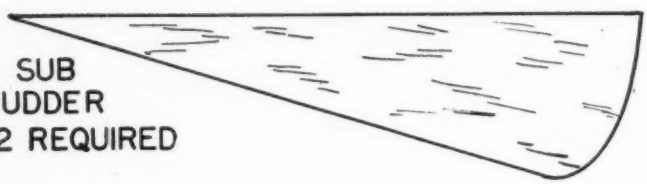
(*Turn to page* 51)






RIB

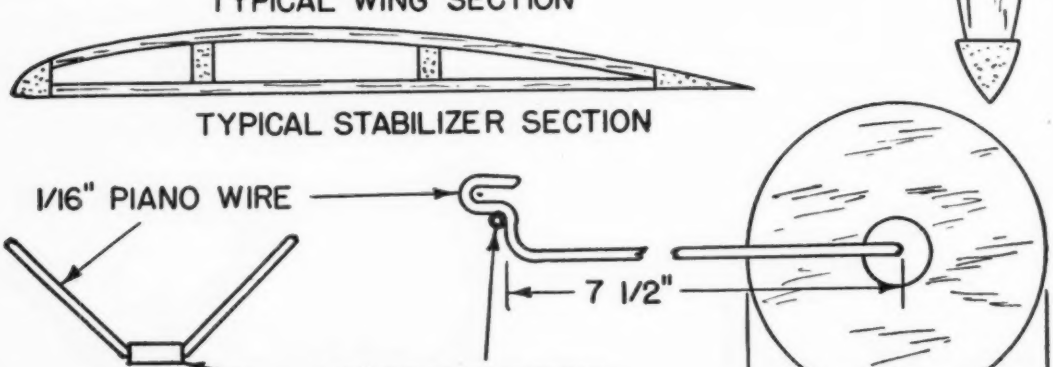
PYLON
RIB


SUB
RUDDER
2 REQUIRED

AIRFOIL TEMPLATE

TYPICAL WING SECTION

TYPICAL STABILIZER SECTION


1/16" PIANO WIRE
7 1/2"
1/8" BRASS TUBING
1 3/4" DIA.

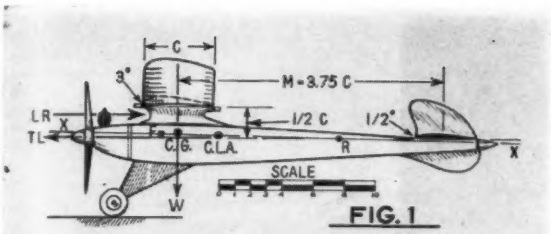


FIG. 1

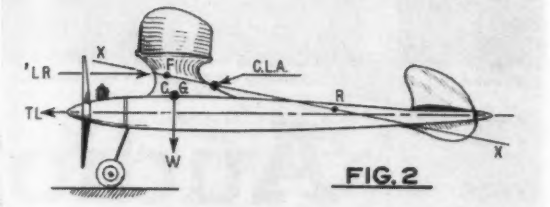


FIG. 2

# design forum

**by CHARLES H. GRANT**

IN spite of the inconveniences and frustrations imposed upon model builders by some motor manufacturers who ship out incomplete power units, a few determined model builders have been mulling over designs for planes that they hope to fly in the Nationals. Many are stymied and often fatally discouraged when they receive their new glow plug motor in the mail without gas tank, gas lead, or automatic shut-off, to say nothing of lack of convenient means for mounting the motor in their airplanes.

In the price war to undersell competitors, each individual motor manufacturer is cutting every auxiliary part from their product in order to keep his price at a minimum. In the process they are overlooking the inconvenience to the purchaser and the discouraging effect upon those who are just starting their career in model aviation. Luckily some model fans, especially the more experienced ones, have the determination and ability to surmount these annoying and unnecessary obstacles. These problems unquestionably bring out the ingenuity and latent ability of the modelers and possibly help to serve as a measure of their capacities. Nevertheless, it is discouraging to those who are beginning and contributes nothing to increasing the number of members of the model building fraternity. In one sense, it takes the form of an elimination trial for the Nationals; only those with the greatest capacity can create models worthy of entering this contest.

However, let us assume that you are one who can readily solve this problem of inconvenience in design. You have a power unit around which you wish to design and build a contest winning plane. Experts with long experience need little advice in this respect but newcomers to the sport are often doubtful how to proceed. It is wise for beginners, and even experts, to choose a course that will enable them to obtain their objective in the most convenient and quickest way.

This suggests a model in the A classification which specifies an engine with piston displacement of less than .2 cu. in. Naturally the smaller the engine, the smaller the airplane will be, and the less construction required. It is much easier to build a small airplane than a big one. On the other hand, smaller airplanes, because of the factor known as the Reynold's Number, do not always have the flight capacity of those with larger wing area. This may be overcome, however, by proper aerodynamic design and careful structural design and building. At least we can say it is most convenient to use small engines, so we will outline the design of a small light plane suitable for contest work, to be powered with engines of .05 cu. in. displacement or less. Such a plane should have an excellent chance of winning a place in the Nationals because it is set up accurately from an aerodynamic standpoint so that it will have stability under *all* conditions of flight, which, of course, makes for duration.

Now let us see what is necessary to build a contest plane around a .05 engine. The first consideration is the displacement of your engine; contest rules specify that the weight of the airplane shall not be less than 100 oz. for every cubic inch of piston displacement, so this airplane must weigh 5 oz. or more. Of course, the closer the total weight is to 5 oz. the better the performance of the plane will be, and we will shoot for a total plane weight of 5 oz. The weight of these engines with gas tank and other necessary auxiliaries runs between 1-1/4 and 1-1/2 oz., leaving approximately 3-3/4 oz. for the structure of our airplane.

To obtain maximum efficiency, factors which contribute to flight (the wings for instance) should be as large as possible and therefore should absorb most of this weight. Other parts of the structure, like the fuselage, landing gear, tail, etc. should be as light as possible, because of the simple fact that the larger the wing compared to the weight, the less the wing loading will be and consequently duration will be greater. For greatest wing efficiency, the aspect ratio (that is the span relative to the chord) should be high. From experience we have found that planes built around a wing of about 180 sq. in. of area can be built within the specified limit of 3-3/4 oz.

From here on the performance not only depends upon aerodynamic design but upon the model builder's capacity to keep structural weight down to a minimum. To give a high aspect ratio we specify a wing span of 40" and a chord of 4-1/2". The next consideration is the stabilizer. The area of this should be from 30 to 33% of the wing area, or about 60 sq. in. The fin area, for proper stability, should be from 5 to 6%; 10 sq. in. should be sufficient. The stabilizer may have a span of 17" and a chord of 3-1/2". The next step is to determine the distance of the tail surface from the wing, M, Fig. 1; it should be approximately 3.75 times the chord, in this case 16". This factor of moment arm M, times the stabilizer area, is the factor of longitudinal stability. The value specified here is large and should keep the model climbing steadily without stalling.

Many of you have noticed that pylon models climb more steeply and gain greater altitude than low wing models of similar design. This is caused by the wing being placed well above the thrust line. As a result the line of resistance is above the thrust line and causes the model to nose up sharply under full power and to fly at a high wing angle of attack. This condition also creates a positive angle of attack on the stabilizer during climb and in this way you obtain lift from both wing and stabilizer. In low wing models the stabilizer seldom lifts and does so only slightly if at all during climb. Often there actually is a down pressure or air load on the stabilizer, which detracts from the buoyancy of the model and reduces the rate of climb compared to high wing planes. For best results, therefore, we will place the wing above the thrust line. If it is too far above, it will raise the center of lateral area excessively even though it may induce a rapid rate of climb. With the C.L.A. high we

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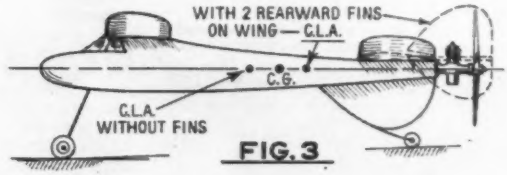


FIG. 3

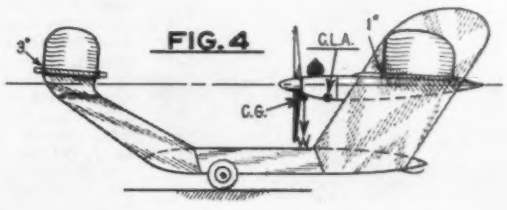


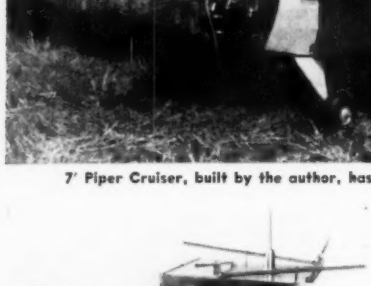
FIG. 4

7′ Piper Cruiser, built by the author, has 3-channel tone control described herewith

John Terry, of Oakland, at the controls

# Audio Tone R. C.

By E. L. ROCKWOOD



5-channel transmitter and control box. Stubs on case carry "ground-plane" rods

Heart of the system is this reed selector shown in comparison with 1-cent piece



5-channel receiver with sensitive relays in line along the bottom

Servo motor equipped with both limit and neutral return switches; weight is 1½ oz.

Synchronator picks audio tones in sequence, enables 5 simultaneous operations, if desired

## Adaptable to single or multi-surface control, the system described is a real advance

IN all the years that have passed since radio control was first introduced to the field of model airplanes, despite all the material published under the heading of "Radio Control," there has been actually little if any progress in the design of the factor which, in the first place, makes remote operation possible—the radio system itself. Certainly little has been published in the popular magazines which shows more than slight modifications of the one-tube idea, during the past ten years or so; at least, nothing that could be squeezed into a model plane. A search of the Patent Office discloses a similar condition.

Desiring a very reliable set of "radio ears" that would catch the slightest whisper of impulse from the controller's hand, yet would not let him down when most needed, the author has spent a number of years investigating various angles of the problem; the answer arrived at has crystallized for the present at least, in the form to be described here.

Early in the investigation it became desirable to use the principle of a carrier wave from the ground, using tone modulation; the major drawback to such equipment seemed in the direction of excessive weight. The army uses tone modulation in their 12′ ships employed as aircraft targets, but the equipment weighs much more than the total flying weight of a model plane. Tone selection is made by heavy tuned circuits, requiring in addition an extra tube per tone, to operate the relay putting into action the particular function selected. That means more battery to be carried, thus still more weight.

At first it seemed that reducing the weight of the tone-selecting "filters," and working along the army lines would be the tack to take. This line of action afforded some relief. To those technically inclined, it may be pointed out that the higher in frequency the tones used, the lighter in weight can be the tuned circuits for their selection. There is, however, a limit to the modulation frequencies which may be used with super-regenerative receivers. It was desirable to stick to use of the latter for several reasons: the sensitivity that may be packed into small, light-weight equipment with low battery drain, the simplicity of the circuit, and the ability of such receivers to ignore interference from the spark ignition circuits of the gas engine. The technical limitation of these receivers is that detection of tones is limited to frequencies less than one-tenth of the "interruption-frequency" of the super-regenerative circuit. Since the latter is, in receivers suitable for this use, around 20,000 cycles per sec., the highest tone to be satisfactorily used is 2000 cycles. A "filter," or tone-selecting circuit, for that frequency is still too heavy, and too many tubes, moreover, must be used for the filter method of tone selection. While the tubes themselves add little weight, they must have batteries in order to function; there is the rub—the more tubes, the more weight that must be carried in the form of batteries.

The radio part of the set was finally boiled down to an arrangement using a maximum of three miniature tubes, operating from a 4-1/2 oz. B battery, with three or four pen-cells to light the fila-

ments. The set was so sensitive to tones that when used for voice communication, it would fill a room with sound from a portable transmitter using considerably less than 1 W of power, at a distance of several miles. In fact, at one time, loud-speaker volume was obtained from signals originating on the East Coast of the United States, with the receiver located here in California; the antenna used was short enough to be fitted from cabin-to-tail of a 6' span model plane.

This was all very encouraging but it didn't constitute radio remote control. Actually, during development of the receiver itself, work was carried on to evolve a method of putting to use the excellent response of the receiver to operate relays from the tones which were so well received. Operation of relays from tones, by having the tones operate tuned reeds which would close low-current relay circuits, was the method finally selected. It is fundamentally not an entirely new idea, certainly, but one which has never been thoroughly exploited for the purpose. The principle is that a small length of steel has a certain speed at which it will naturally vibrate when secured at one end with the rest of it free. If acted upon by an electro-magnet near the free end, with the current through the coils of the magnet varying in strength at a speed corresponding to the "natural period" of the piece of steel or "reed," the latter will vibrate vigorously. If the current through the coils be varied at any other speed, the reed will hardly vibrate at all. The natural period of the reed is determined by its length, width and thickness, as well as the material of which it is made. Steel was chosen for its stiffness and its ability to be affected by a magnetic force.

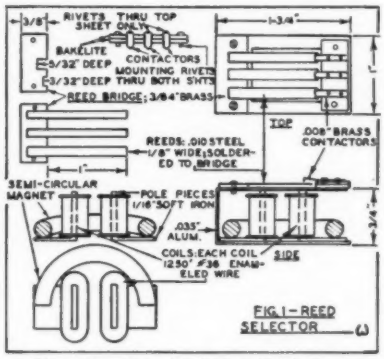
Fig. 1 shows the arrangement whereby a pair of coils connected to the receiver, like a loud-speaker, cause the reeds to vibrate from the receiver's output. The three reeds shown have different free lengths, being secured at one end to a "bridge." One certain tone, and only one, will cause one of the reeds to vibrate sufficiently to touch the contactor located above it. Each of the reeds may be caused to vibrate selectively at will, by sending into the receiver the tone which corresponds to its natural period. Vibration of the reed sufficient to cause it to touch its individual contactor will rapidly open and close a circuit through the reed and contactor, and may be made to hold a sensitive relay closed as long as the vibration continues. The vibrating contact, however, will cause a chatter of the relay, and its contacts will not close tightly. The arrangement of condenser and resistor shown in Fig. 2, called the "reed filter" smooths out the chatter, and the relay closes firmly whenever the reed hits its contactor during vibration.

Only a small current may be controlled by such a reed and contactor simple enough to be compact and light in weight for our purposes. It is necessary to use the current passed by this arrangement to open and close a sensitive relay such as is used in all radio controls, to actually work the motor or escapement circuits which will move the rudder or other control surface of the airplane. One relay is connected to each reed-contactor circuit, and each relay may therefore be individually selected at will by the tone which is sent out from the ground transmitter. Each tone will have the effect of controlling a separate control function of the plane. See Fig. 2.

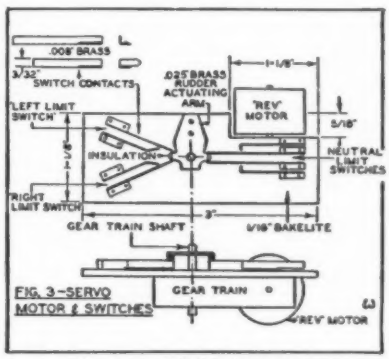
Fig. 2 shows the servo circuit used for rudder. When the "left relay" is pulled up by operation of the reed connected to it, a circuit is closed through the "left servo battery," causing the servo motor to rotate in a direction to move the rudder to the left. The motor speed is reduced through a gear-train with a ratio of about 300-to-one and an arm fastened to the shaft of the lowest-speed gear is connected to the rudder, as the operating rod is connected in U-control, from the bellcrank to the elevator. A satisfactorily light-weight motor for this purpose is the *Rev* motor, which is very light-weight and small and uses about the amount of current consumed by a flash-light bulb. A convenient gear-train, light in weight and inexpensive may be adapted from the works of a small spring-driven toy of which there are many to be found in toy and novelty stores. The spring is removed, and an operating arm attached to the end of that shaft. The wheels of the toy (an automobile, usually) are removed, and the *Rev* motor connected to that shaft. This may be done by a pulley and small rubber band drive or by substituting the shaft of the *Rev* motor for the wheel axle. The resulting actuator may be held down to a total weight of around 1-1/2 to 2 oz. including the motor.

When the motor has driven the control arm to the desired distance to the left, the limit switch stops the motor. As long

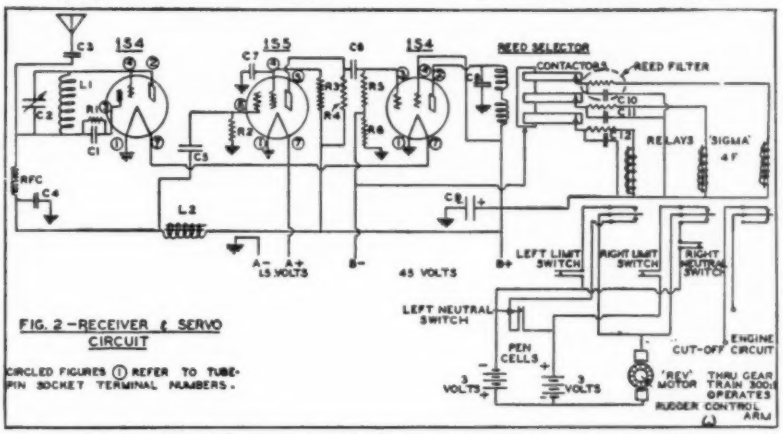
(*Turn to page* 54)



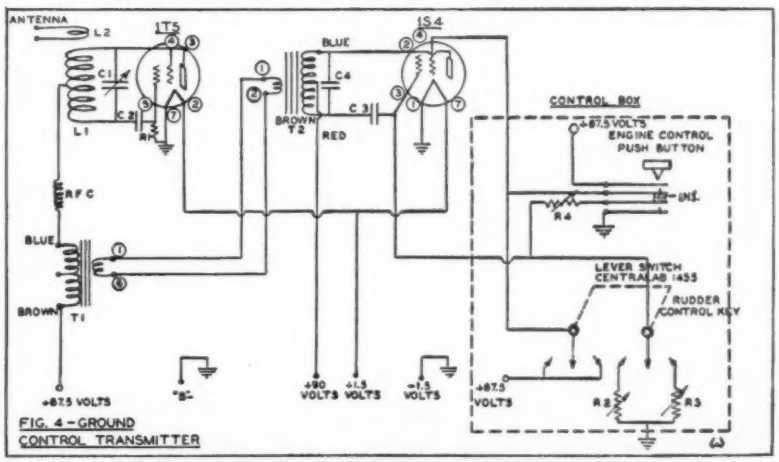

**Three-channel reed selector. Notches in bridge produce different reed lengths**



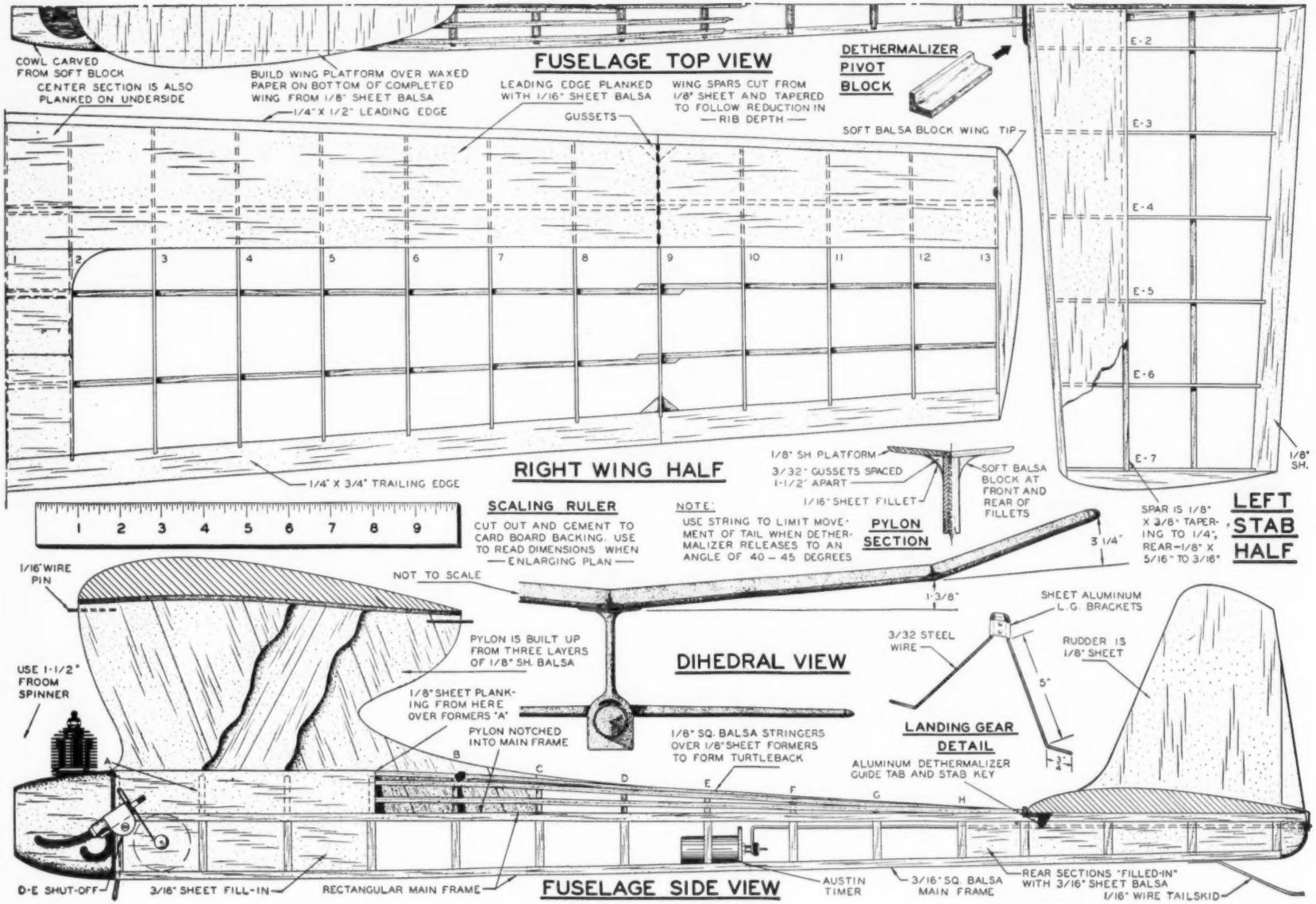

**This servo unit has both neutral limit and right-left limit switches**




**Complete receiver diagram. A and B batteries for the receiver are not shown here**




**The transmitter is very simple. This circuit omits the *Synchronator***


FUSELAGE TOP VIEW
COWL CARVED FROM SOFT BLOCK
CENTER SECTION IS ALSO PLANKED ON UNDERSIDE
BUILD WING PLATFORM OVER WAXED PAPER ON BOTTOM OF COMPLETED WING FROM 1/8" SHEET BALSA
1/4" X 1/2" LEADING EDGE
LEADING EDGE PLANKED WITH 1/16" SHEET BALSA
GUSSETS
WING SPARS CUT FROM 1/8" SHEET AND TAPERED TO FOLLOW REDUCTION IN — RIB DEPTH —
DETHERMALIZER PIVOT BLOCK
SOFT BALSA BLOCK WING TIP
1/4" X 3/4" TRAILING EDGE
RIGHT WING HALF
E-2
E-3
E-4
E-5
E-6
E-7
1/8" SH.
LEFT STAB HALF
1/8" SH PLATFORM
3/32" GUSSETS SPACED 1-1/2" APART
1/16" SHEET FILLET
SOFT BALSA BLOCK AT FRONT AND REAR OF FILLETS
PYLON SECTION
SPAR IS 1/8" X 3/8" TAPERING TO 1/4", REAR—1/8" X 5/16" TO 3/16"
SCALING RULER
CUT OUT AND CEMENT TO CARD BOARD BACKING. USE TO READ DIMENSIONS WHEN — ENLARGING PLAN —
NOTE:
USE STRING TO LIMIT MOVEMENT OF TAIL WHEN DETHERMALIZER RELEASES TO AN ANGLE OF 40 – 45 DEGREES
1/16" WIRE PIN
NOT TO SCALE
3 1/4"
1-3/8"
DIHEDRAL VIEW
SHEET ALUMINUM L.G. BRACKETS
3/32 STEEL WIRE
RUDDER IS 1/8" SHEET
5"
LANDING GEAR DETAIL
3/4"
ALUMINUM DETHERMALIZER GUIDE TAB AND STAB KEY
USE 1-1/2" FROOM SPINNER
PYLON IS BUILT UP FROM THREE LAYERS OF 1/8" SH. BALSA
1/8" SHEET PLANKING FROM HERE OVER FORMERS "A"
PYLON NOTCHED INTO MAIN FRAME
1/8" SQ. BALSA STRINGERS OVER 1/8" SHEET FORMERS TO FORM TURTLEBACK
A
B
C
D
E
F
G
H
D-E SHUT-OFF
3/16" SHEET FILL-IN
RECTANGULAR MAIN FRAME
FUSELAGE SIDE VIEW
AUSTIN TIMER
3/16" SQ. BALSA MAIN FRAME
REAR SECTIONS "FILLED-IN" WITH 3/16" SHEET BALSA
1/16" WIRE TAILSKID

# Vixen

By CLAUDE McCULLOUGH

THE moral of the story of the *Vixen* is short and to the point. "Keep your dethermalizer in good operating condition." Because I didn't, the contest career of the original ship was likewise short.

First, brought into the fray at the Tallcorn meet, the *Vixen* quickly snagged one of the sparse thermals on "A" day and turned in good time to buoy my hopes while trying to extract it from hiding in a huge cornfield. Getting back to the field late in the afternoon, we found our good friend Dutch Hess, of De Kalb, Ill., firmly entrenched in the top spot in Class A. Two more flights with the motor having fits of temperament left Dutch still on top with a 30 sec. edge and yours truly in second place. However, I had the last laugh in this instance, for when the sponsors of the meet were unable to pay off the myriad of bills run up in promoting the big contest, Dutch was left holding the bag for a prize. Meanwhile the local Plymouth dealer donated a $200 trip to Detroit for the best home-town performance, a prize I was pleased to accept!

At Detroit, of all places, the balky motor balked its last and I gave it the heave-ho and installed another before tackling the annual *Waterloo Prop Twisters* meet, one of the best in the Midwest. Fellow clubman John Heasley, home from college on vacation, found the simple lines of the *Vixen* the correct prescription for scarcity of building time and quickly turned out an *Ohlsson 23* version. Test flown the night before the contest, he soon had it performing so well that the next day he handily won first in Class B.

But to return to the moral—originally the dethermalizer installation was permanently fixed with a wire and tubing hinge. Of course you can guess what happened —as I should have known it would. On a hard landing the hinge tore loose and in the contest hustle the break was left unrepaired. So although I was lucky in snagging only a weak thermal on the first flight at Waterloo and none on the second, on the third my fate caught up with me. After a 6:33 official flight, which insured first place in Class A, *Vixen* disappeared into the blue. And I *mean* disappeared. For when it turned up months later during the corn picking season, it was some 25 mi. away.

Several others have now been built on the strength of the fine climbing and gliding abilities of the first two versions, but they have a slight alteration, which you may note on the plan—a much more sensible and simpler dethermalizer hinge arrangement.

You should find the *Vixen* just the thing for the present contest season, with the '49 rules the same as last year.

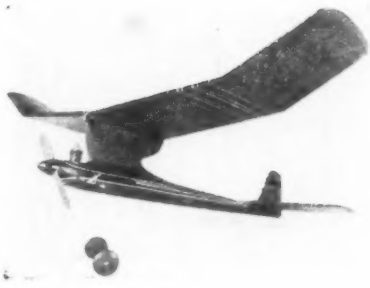
The plans may be easily enlarged by use of the scale ruler which appears on the plans. With this, all dimensions may be taken directly from the drawings. Full size patterns of all ribs and formers make drawing up the working plans a task that should not dismay anyone.

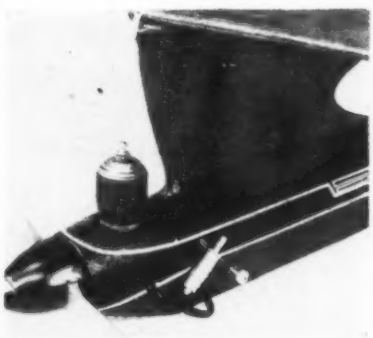
The fuselage is simple but strong. Build the sides of the rectangular main frame one on top of the other and connect them together. Add the pylon, built up from 1/8" sheet laminations, notched to fit into the top of the fuselage main frame and sanded to streamline shape. Cement formers A to H in place, planking with 1/8" sheet over formers A and add 1/8" stringers over the rest, to form the turtleback on the fuselage.

The motor used should preferably be a radially-mounted type such as *Arden 19*, *Ohlsson 23* or *K&B 24*. These may easily be mounted by cementing the nuts on the back of the plywood firewall and bolting to it directly. If you want to use some other type of motor, small mounts may be made from galvanized sheet metal. For motors other than an *Arden*, a gas tank must be mounted in the fuselage. It is recommended that this be sealed in the fuselage permanently with U-control type filler tubes protruding out of the planking.

On the original ship a *D-E* fuel shutoff valve was used and gave dependable service. Other types such as the *K&B* and *Austin* may also be used with slight modification to fit their operation. At this point I would like to say an enthusiastic word concerning the use of glow plug engines in free flight. There has been some oppo-

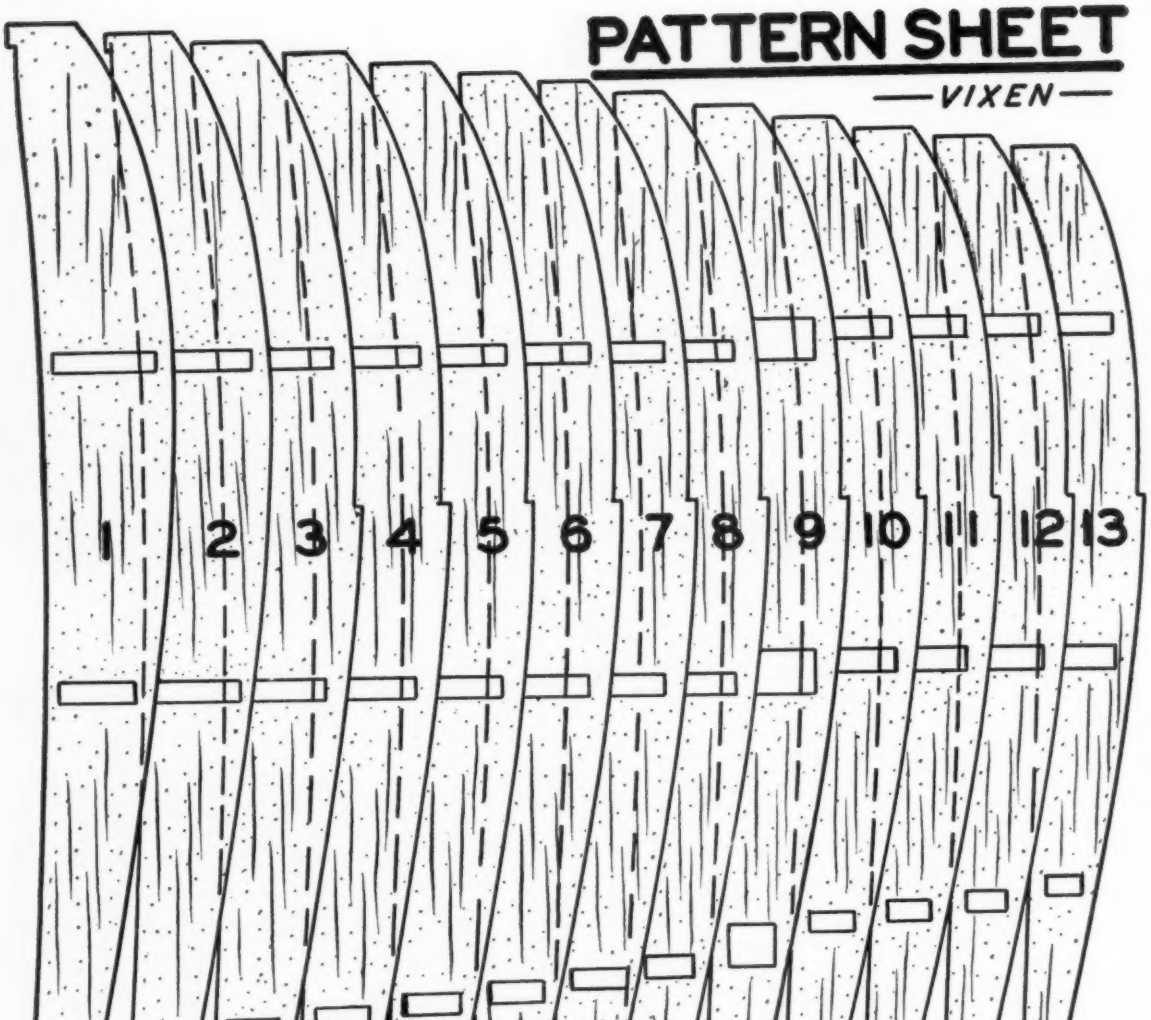
(*Turn to page* 36)



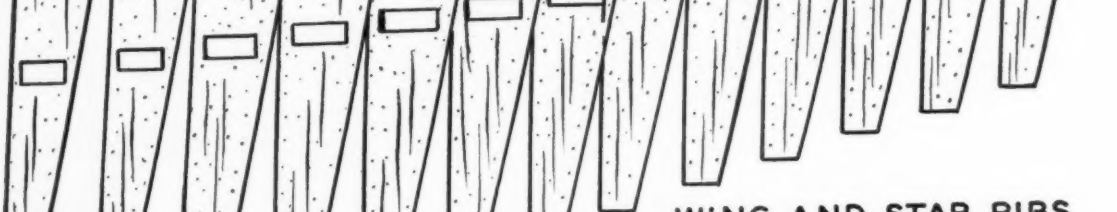


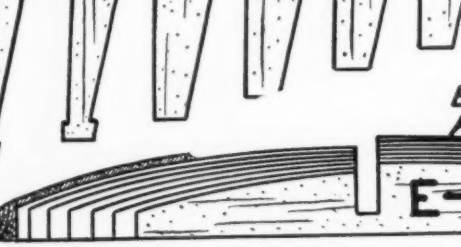
# PATTERN SHEET

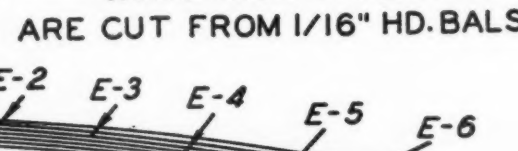
—VIXEN—




WING AND STAB RIBS
ARE CUT FROM 1/16" HD. BALSA



1/16" PLYWOOD CENTER—
DIHEDRAL BRACE

cdm

# WORLD WAR I

## PART TWO

by ROBERT C. HARE

LAST month we discussed the basic design characteristics of the Roland C.II, and the thinking of the designer, Roland, which led to this highly advanced L. F. G. type.

While Roland had at his disposal a lot of theory regarding streamlining in general, the methods of obtaining smooth airflow over particular contours and protuberances were something he had to work out from scratch. Roland was the type of designer whose "dream plane" was theoretically a step in the right direction, but materials, components, and mechanics of components at his disposal lagged technologically.

Determined to keep the C.II the cleanest plane in the air, Roland completed the fuselage of his ship in a most modern manner. Because of the body's unusual depth, the Mercedes 160 hp engine was almost completely covered as will be seen in the illustrations on this page. Only the two front cylinders were exposed. This effect was achieved by providing right- and left-hand sheet aluminum cowling sections attached to the upper stringers and to small metal fittings bolted to the engine. These cowl pieces were long and narrow, contour-formed to clear engine accessories, and attached with quick-disconnect fittings. The nose of the fuselage was finished off in a blunt front circular cap made of upper and lower halves. Each half was slit-louvered and attached with screws and buckles. This particular piece was formed on a drop-hammer, cut in half and louvered by hand.

Streamlining of the front end was finished off with a spun aluminum bonnet, or spinner, covering the propeller hub. The spinner was attached to an aluminum disc bolted to the back of the hub.

The usual variety of hinged and removable inspection panels were provided on each side of the nose.

Working aft, Roland took the streamlining of fuselage details as seriously as he did the contours and general configuration. Upper and lower wing stubs, for instance, were integral with, and grew out of the fuselage. Since the depth of the fuselage filled the gap, there was no center section. Internal structure of the wing roots consisted of husky spars attached to the two "backbone" formers mentioned last month, and to secondary structures built on the same members.

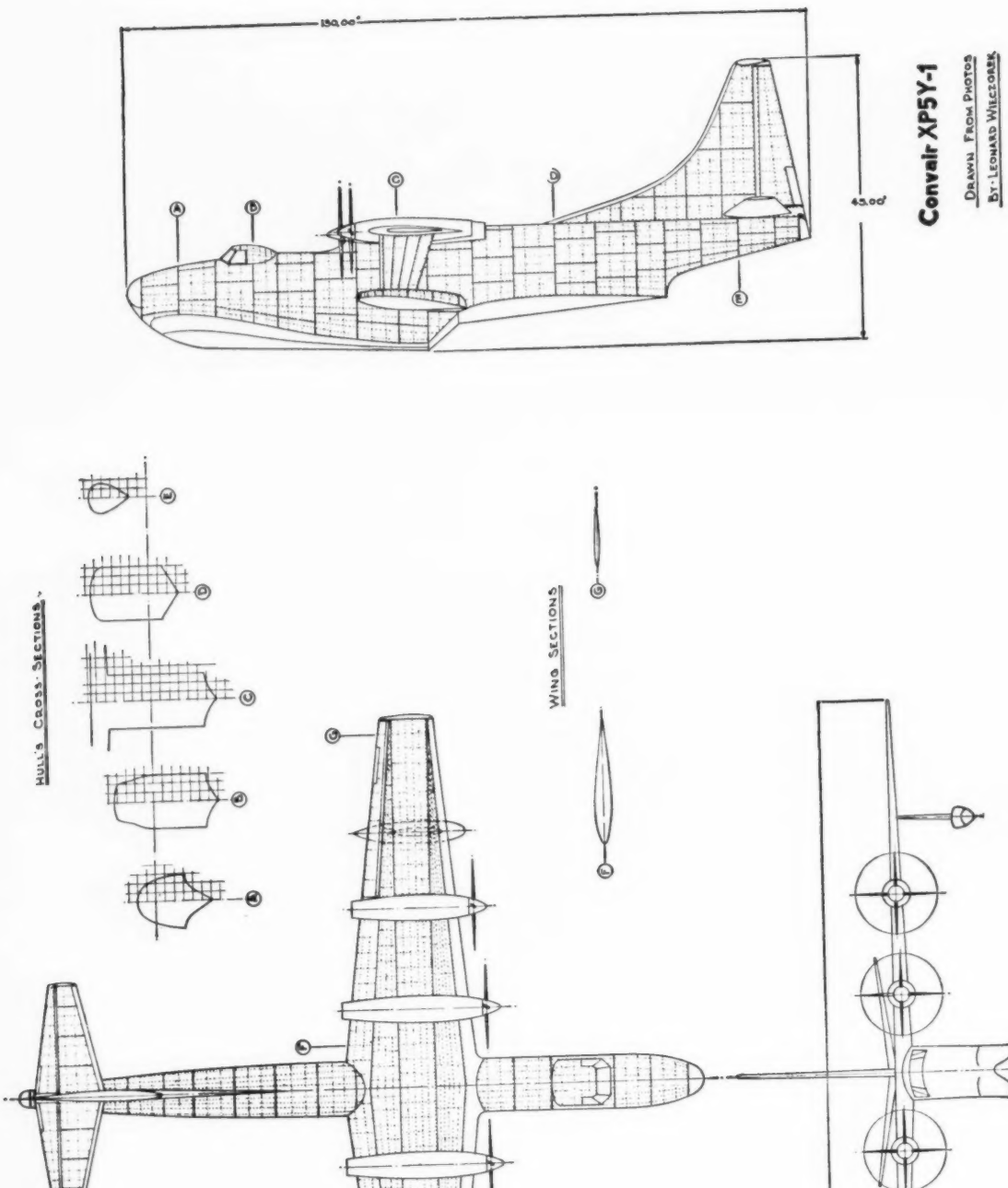
The short chord of the upper wing stub was followed by the pilot's cockpit cutout. The pilot's eyes were several inches above the upper wing, which was even with the top of the fuselage, and provided him with an excellent vision forward and above. His vision downward was enhanced by huge cutouts in the trailing edges of both wings where they joined the fuselage wing stubs. By leaning forward slightly a pilot could easily see under the upper wing, as well. In addition, both pilot, and the observer, who sat behind him, had increased vision provided by four large side windows, placed two to each cockpit. Windows were made of heavy sheet celluloid held in place by hinged aluminum frames. These windows were probably the first intentional escape hatches in aviation history—they were large enough for a man to crawl through, and were operable only from the inside.

The importance of an escape hatch in the C.II was the solution to a real danger—in an overturned Roland C.II, the cockpits were practically flush with the ground. These window-hatches were provided in spite of overturn equipment consisting of crossed semi-circles of steel tubing attached to the fuselage top just forward of the pilot's cockpit. This structure is visible in the photographs reproduced here, and it can be seen that it provided a handy place to hang the pilot's rear-view mirror.

A series of flush-covered steps provided access to each cockpit. The pilot was equipped with a very small celluloid windscreen which, because of the airflow around it, offered considerable protection. At his disposal were the usual flight and engine instruments—altimeter, airspeed indicator, ball-turn indicator, compass, tachometer, pulsometer, switches, etc. Early L. F. G. C.II's were equipped with an anemometer type airspeed indicator attached to the upper wing just outside the propeller slipstream.

Pilot's flight controls were standard. The observer was equipped with dual controls, including a removable stick; an

(*Turn to page* 38)


130.00'
45.00'
Convair XP5Y-1
Drawn From Photos
By-Leonard Wiegforek
Hull's Cross-Sections
Wing Sections
A
B
C
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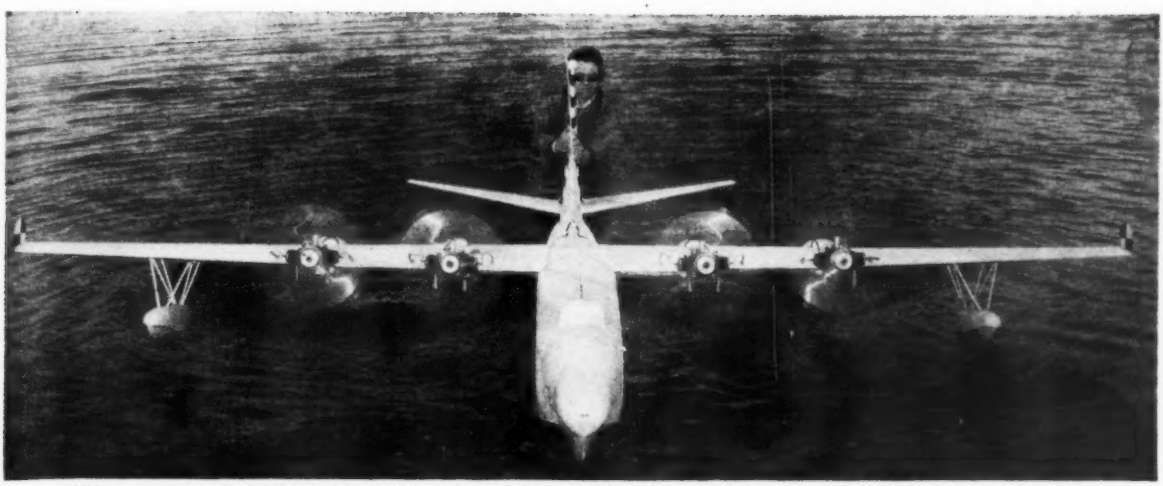
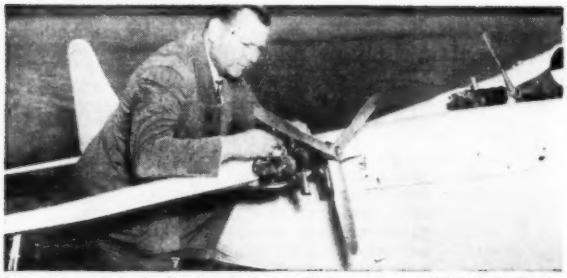


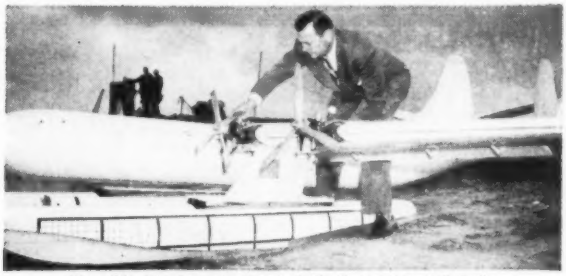
Motors screaming, the XPY5-1 model is held back by technician awaiting release signal from remote "pilot" at the radio transmitter

# Radio Control "DELUXE"

An unpowered R.C. job is prepared for catapult launch to check landing reactions



Convair expert E. G. Stout adjusts 2-cylinder motor on XP4Y-1 duplicate



Here Mr. Stout works on a twin-float experimental design

**by ROBERT McLARREN**

THE day of the dare-devil test pilot has passed. No longer does a leather-garbed adventurer climb aboard a rakish new aircraft and take his life in his hands as he races down the runway on the first flight of an experimental airplane. By the time a modern prototype taxis to the take-off point, its designers already know almost all there is to know about the new craft, and the first test flight is actually an anticlimax!

While this procedure may dull the enthusiasm of the layman, the saving in time, money and risk is a remarkable tribute to scientists and engineers of the modern aircraft industry who have reduced yesterday's guesses to today's known facts. The purpose of all aircraft research is to reduce aerodynamic phenomena to accurate formuli and design charts that can be used safely *in advance* of the construction and flight of a projected airplane. The past 30 years have witnessed an astonishing improvement in design methods through the use of which the exact performance and characteristics of an airplane may be known in advance.

One of the earliest of these methods was the use of the wind tunnel in which a scale model of the projected airplane is placed and its lift, drag and pitching moment obtained. Another early method, still in widespread use, is the testing of full scale assemblies of the airplane in a structural testing laboratory to determine the exact load the structure will carry before failure.

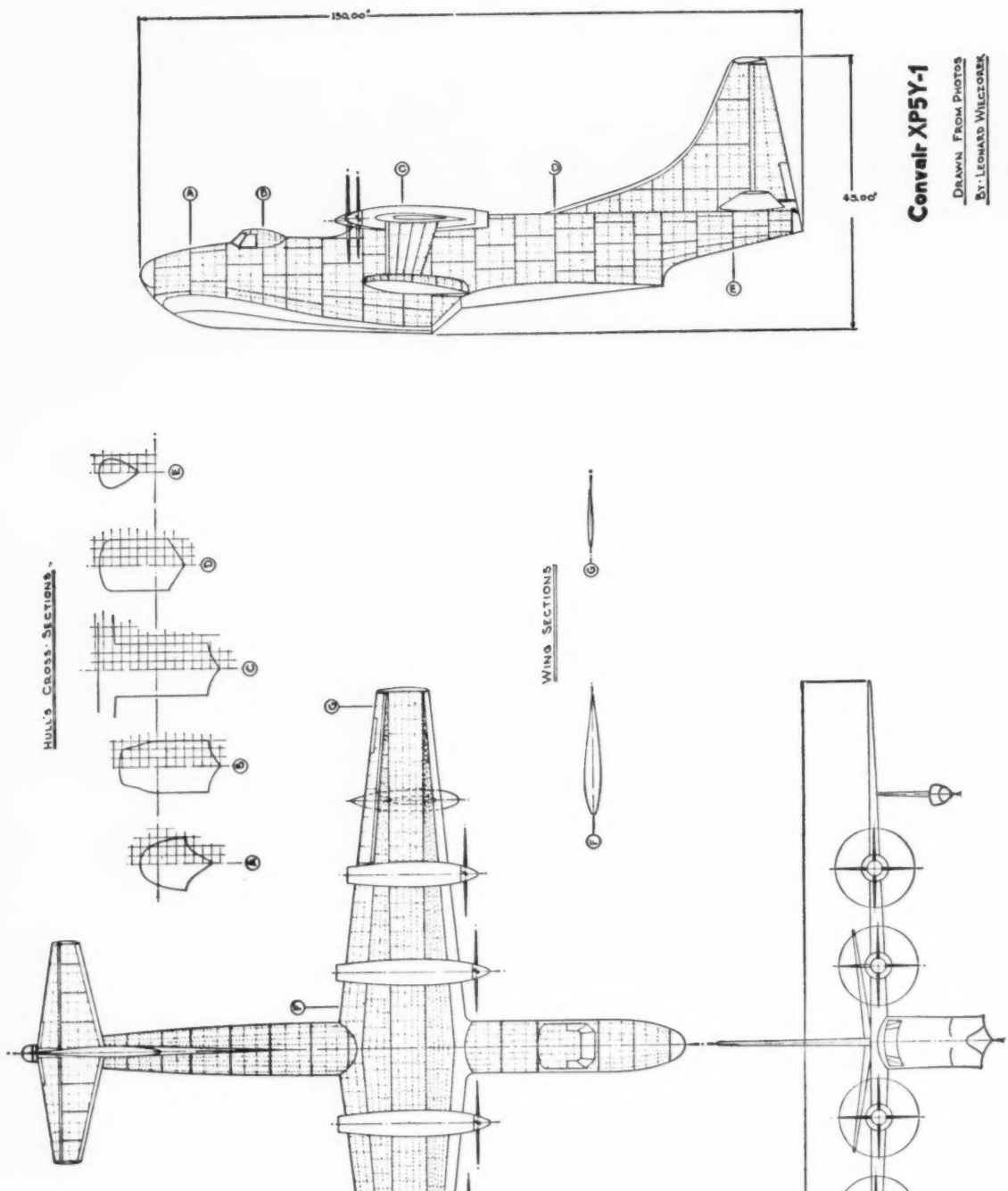
During the late 'thirties the spin-tunnel was created into which scale models can be tossed and the spinning characteristics, together with recovery methods determined. For flying boat models, the towing basin has proved highly accurate in determining the hydrodynamic characteristics of the airplane. But throughout these years of research, during which a huge mass of testing techniques and methods of evaluation have been developed, no method had been developed for testing the effects of power on the model, and these effects can be large and serious when not known with sufficient accuracy in advance.

And so it was not until World War II that accurate methods of dynamic testing of aircraft models were evolved. In this method, small engines are actually mounted in the model and it is flown under its own power so that the full-scale aircraft is duplicated in every detail.

With the addition of thrust and the ability of the model to move in three dimensions, numerous problems are created which have not yet been completely solved, but remarkable progress has been made.

One of the first problems in dynamic model testing is the necessity for making the model "dynamically similar" to the full scale airplane; that is, the weight in the model must be distributed in a manner identical to that of the projected airplane. This problem is well known to model builders who have attempted to design exact-scale powered models of large aircraft by the simple expedient of using full scale aircraft draw-

(*Turn to page* 46)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A
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Convair XP5Y-1
Drawn From Photos
By Leonard Wilcoxen
Hull's Cross-Sections
Wing Sections
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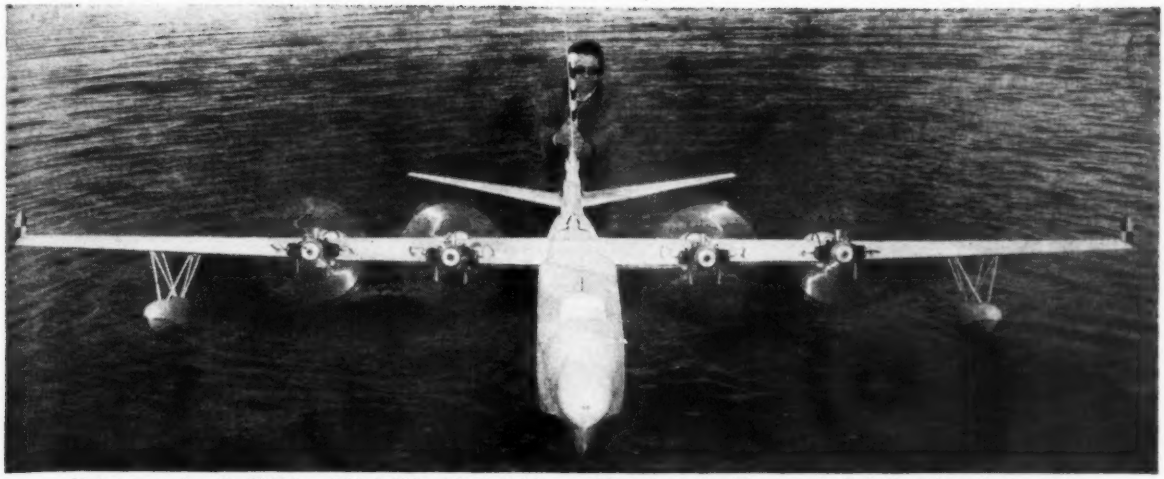

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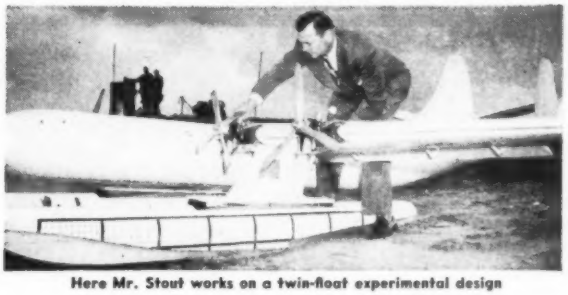

Here Mr. Stout works on a twin-float experimental design

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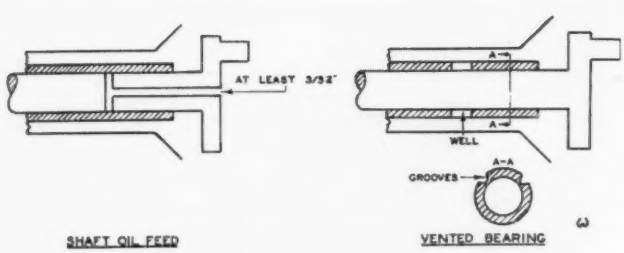
(*Turn to page* 46)

by ROY L. CLOUGH, Jr.

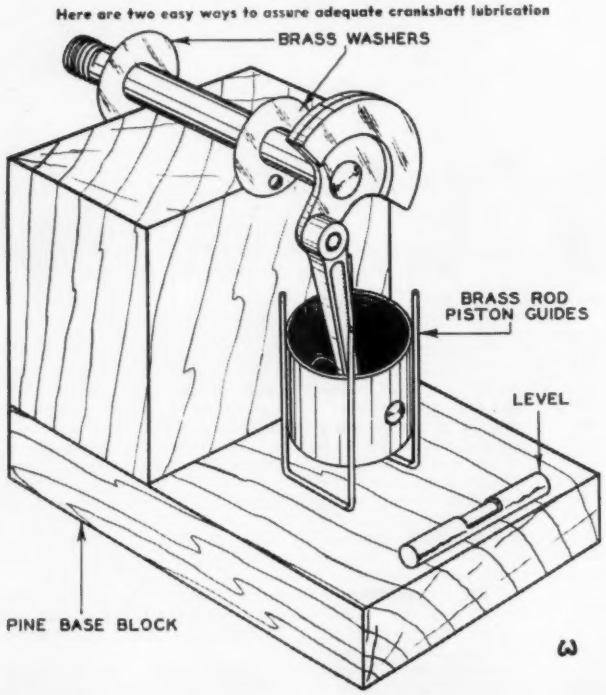
# REBUILD IT? ☒ Yes ☐ No

**Dig out those outdated engines and turn them into "hot jobs" as suggested herein**




MORE SPEED REQUIRES MORE LUBRICATION

Here are two easy ways to assure adequate crankshaft lubrication




CRANKSHAFT BALANCING JIG

Shaft must turn easily in the washers, and piston should slide smoothly

IF you have a box full of old clunkers that won't run any more, or never did run right, there is plenty of fun to be had and a lot of 2-cycle know-how to be gained by tearing them apart, operating on their innards and sticking them back together a bit differently.

But don't think we are going to uncork some magic method of chopping up a *Dooling* or *Hornet* one day and setting a 200 mph record the next. Far from it. If you have a hot racing motor and a yen to get a little more out of it, we would suggest leaving the mechanical end strictly alone, and concentrating on fuels and propellers.

Rebuilding, as we shall present it here, means altering old engines to give them more speed and power, or, for experimental purposes, to make them run in an entirely different fashion than the maker intended.

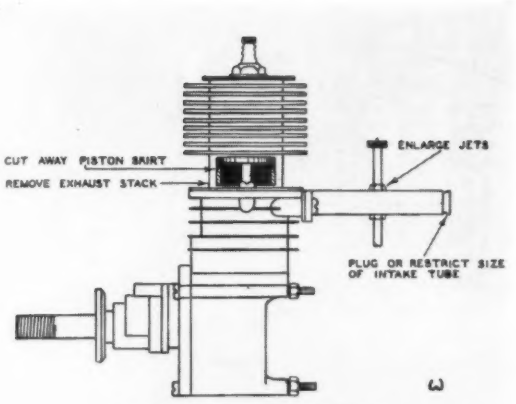
Some motors, and this includes most of the older ones, can be rebuilt easier than others; a few offer very little opportunity for rework because of special or unusual assembly methods. Select your first "victim" with an eye to easy and complete disassembly, simple design and, of course, low cash value.

If you have the urge, but no old engines, drop in on your hobby dealer and see what he has taken in trade. Quite often you will be able to pick up a pretty good subject for a dollar or two. And, while on the subject of second-hand engines, one can often pick up samples that are neither old, nor junk, just by keeping one's eyes and mind open. We once saw a nearly new *O.K. 29* on which a refund had been demanded. The only thing wrong with it was that somebody had fiddled around with the position of the needle valve body, moving it over so far the jets were covered by the intake casting. An *O & R .19* which never ran had, in some inexplicable fashion, acquired a bit of wax paper blocking the intake completely. We could also mention a *Rocket .46* with a spot of dope on a breaker point and a $6 *Atom* that "had no compression" until we picked a sliver of balsa out of the sub-piston.

Occasionally, one runs across an engine of odd or limited manufacture. Nobody buys it because they never heard of it, but—look it over anyway. If it is well made and the compression quite good, why not buy it?

Replacement parts are seldom as big a problem as they seem at first glance. After all, the idea is not necessarily to replace the damaged part with one exactly like it, but to replace it with one that will function just as well! A little scouting around will reveal literally dozens of interchangeable parts among the many engines manufactured.

To mention a few: *G.H.Q.* and *Bond .57* parts will swap around in great style, the *Super Scrapper* crankshaft will fit some old *Phantoms* and vice-versa (you'll have to cut a rotary valve hole). *Syncro PC-2* and *Pioneer Brown* have




SKIRT PORT CONVERSION

many interchangeable parts with *Rogers* and *KD-29*. In fact, in this broad grouping of all die-cast engines it is possible to put together something which will run by picking up parts almost at random. The commutator timer of the *Rogers* engines, which functions quite well if the brushes are kept in good condition, can be adapted to a great many engines. Sometimes in swapping connecting rods around it will be found that the holes are the wrong size. This is easily fixed by drilling and reaming if the rod hole is too small, or by inserting a short length of brass tubing with the correct I.D., if too big. The important thing in replacing a connecting rod is to make certain that it is of the proper length so that the ports will open when they should and that there is ample clearance at quarter-stroke between rod and the side of the crankcase or cylinder.

Now, before we get any deeper into the subject, what tools are required? The first, and most indispensible item is a set of good pattern maker's files, or equivalent, a few drills, various grades of abrasive cloth, a hacksaw and a few small wrenches. Power tools are a great help, but can be done without for most of simple reworking jobs. For the rest, simple gadgets can be made up as one goes along.

One thing to keep uppermost in mind when rebuilding any engine is that metals must never be thinned out below safe minimums. Model gas engines are subjected to very considerable pressures and temperatures. To lack cognizance of these factors, is to invite trouble. Use a little plain old-fashioned horse sense with regard to the materials employed. Each engine is an individual case and it is difficult to lay down any hard and fast rules. Steel may be thinned out far more than cast iron, and when working with aluminum in particular remember that not only must the metal itself be thick enough on cylinder heads to withstand the strain of firing, but also due allowance must be made for thread holding capacity—otherwise you may wonder where that spark plug went in such a hurry!

Sometimes simple reworking will consist of doing things that should have been done at the factory, or of unfouling things that may have been done by a previous owner. We have had three engines of one make in which the port timing did not agree at all. By grinding off a cylinder base here and adding a gasket there things were soon set to rights.

Now for some hopping-up. There are three main mechanical factors which determine the speed and power of a two cycle engine. These are: *port area, balance,* and *bearing efficiency.* Having selected your "victim," look it over for a chance to improve the application of any of these three. Make up your mind to do it the safe way, that is, one step at a time. This way you can check your rpm after each step and see exactly how much or how little fruit your efforts are bearing.

The logical place to begin is by checking for excessive friction in the main bearing(s), wrist pin, and crankpin bearings. Sometimes the wrist pin becomes frozen to the connecting rod with the result that the piston bosses are actually functioning as bearings, which doubles the friction at this point. Free the rod if necessary. Next, assemble as much of the engine as needed to check the alignment of the rod with the crankpin. If the con rod holes are not quite square to the plane of shaft rotation, there may be a slight binding at some point, or the piston may show a slight tendency to roll as it reciprocates—both absorb power so give the bearing a bit more clearance. A bit of crocus cloth wrapped around a small dowel does the trick. Examine the crank throw for scoring or pitting, polishing if necessary.

Now tackle the main bearing. With the timer removed, the crankshaft should spin very freely without hitting the crankcase at any point. A visual examination is helpful here. If the shaft does not turn freely and is not bent, there are two possible reasons: the engine may never have been broken in, or it may have seized up. The first is nothing to worry about, but in the second case the bearing surface may be torn or fractured and should be replaced. Usually it is a simple matter to press out a bearing with a length of rod by carefully squeezing in a vise. Use considerable caution and watch out for shoulders which space the proper clearance between the crank disk and the front of the case. Generally the bearing must be pushed inward to free; sometimes there is a tiny set screw used to lock it in place.

If the bearing seems all right on a free spin, hold the case in one hand and pull on the shaft as it is turned to make certain the thrust surface is smooth. Most of the older engines do not have ball thrust bearings, but it is often a simple matter to install something like a single race O & R bearing. This is well worth while as it will often yield 500 rpm or more toward higher top speed.

Since the engine will operate above design speed, it is well to consider the lubrication of the bearing at some length. If the motor is of the shaft rotary type, this is enough; but if there is no provision to get oil to the shaft, better fix it up. Oilite bearings are widely used and are very effective in themselves, but for high speed operation make certain there are oil grooves cut in the face. Better yet, drill an oil feed channel into the crankshaft. If the shaft is too hard to drill, remove the bearing and cut about 3/32" out of the middle of it. Push the front half in place first, then file a couple of grooves lengthwise along the rear half and push it into place so that there is a gap of 3/32" between the two halves. There you have a self-feeding reservoir which will insure ample lubrication. Before leaving the subject of bearings, we advise that all sizing be done with a hone or reamer, never with lapping compound, as this substance may work into the pores of the metal and provide a later source of embarassment.

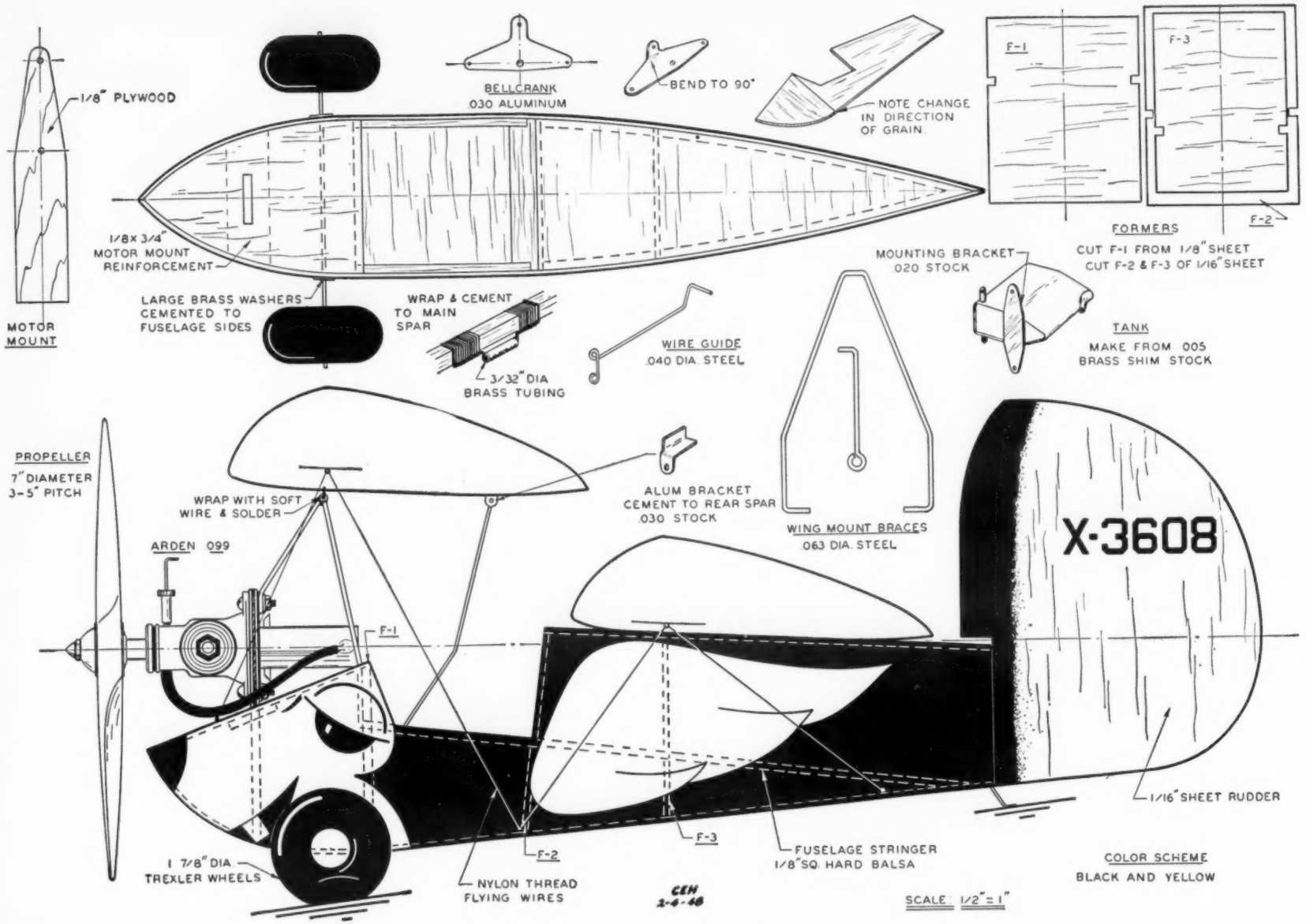
The next thing to tackle is the balance of the crankshaft, connecting rod, wrist pin and piston assembly. On many of the older engines and quite a few of the more modern jobs the counterweighting leaves something to be desired. It is possible to pick up considerable rpm by balancing alone. There are several methods of doing this, and since these shortcomings of balance are generally sins of omission, the cure is usually found in adding weight opposite the crankpin. If the crankshaft is not of the hardened variety, holes can be bored in the counterweight and filled with lead or type metal. If the shaft is hardened, or there is no room for adding weight, don't give up the idea since it is often effective to counterweight the drive washer or propeller back plate provided this article could be keyed in the proper position.

A jig of some sort is necessary. The classical method is to use two knife edges, but a couple of brass washer with holes of the right size, mounted as shown in the sketch is very effective. Poke the shaft through the washers, make certain it spins freely, then hang the connecting rod and piston assembly on

(*Continued on page* 44)

ROY L. CLOUGH, JR.

ROY doesn't normally look as severe as this picture would indicate (a "passport photo" was all he could supply us). In fact, he usually smiles happily while at work on some unorthodox model or power plant. He has flown models driven by bamboo bow, rubber, steam, compressed air, electricity, athodyd, pulse jet, and gas engines. Also has built and flown ornithopters, saucers, autogiros, helicopters, flettners, tailess, wingless, and conventional jobs. He would rather find a new wrinkle than win the Wakefield. An experimentalist at heart, Roy usually has six or eight models a-building at once.


1/8" PLYWOOD
BELLCRANK .030 ALUMINUM
BEND TO 90°
NOTE CHANGE IN DIRECTION OF GRAIN
F-1
F-3
F-2
FORMERS
CUT F-1 FROM 1/8" SHEET
CUT F-2 & F-3 OF 1/16" SHEET
1/8 x 3/4" MOTOR MOUNT REINFORCEMENT
MOTOR MOUNT
LARGE BRASS WASHERS CEMENTED TO FUSELAGE SIDES
WRAP & CEMENT TO MAIN SPAR
3/32" DIA BRASS TUBING
WIRE GUIDE .040 DIA. STEEL
MOUNTING BRACKET .020 STOCK
TANK
MAKE FROM .005 BRASS SHIM STOCK
PROPELLER
7" DIAMETER
3-5" PITCH
WRAP WITH SOFT WIRE & SOLDER
ALUM BRACKET CEMENT TO REAR SPAR .030 STOCK
WING MOUNT BRACES .063 DIA. STEEL
ARDEN 099
X-3608
1 7/8" DIA TREXLER WHEELS
NYLON THREAD FLYING WIRES
CEH 2-4-48
FUSELAGE STRINGER 1/8" SQ. HARD BALSA
1/16" SHEET RUDDER
COLOR SCHEME
BLACK AND YELLOW
SCALE: 1/2" = 1"

# The Flying Flea

By CHARLES HOLLINGER

The author squeezes into his *Flea* (He's a trick photography expert, folks!)

THE name *Flying Flea*, or better yet *Pou Du Ciel*, will remind old-timers of the days when nearly every basement carpenter had a *Flea* under way. This radical departure in the ultra light plane field was dreamed up by a quiet little Frenchman, Henri Mignet. He officially unveiled it to the aviation world at the Paris Aero Show way back in 1934 and within two years "Fleas" were swarming over the European Continent. They were just catching on here in the United States when the craze died out as fast as it had started. Possibly the main cause for this was the fact that due to so many being constructed by inexperienced persons, there were a few serious crack-ups.

Regardless of the faulty jobs turned out by some of the basement workshops, the design has a great deal of merit. The ships were powered with motors ranging in size from 20 to 35 hp, and ready to fly, checked in at the phenomenally light weight of 250 lbs! No wonder they could take-off, fly, land again and come to a stop within a distance of 300 ft.

The model *Flying Flea* weighs all of 7 oz. yet it is plenty sturdy and can take the roughest treatment because of its compactness. By devoting just a little extra time to the novel paint job as used on the original model you will be well rewarded when the modelers gather around to stare at it.

Begin fuselage construction by cutting out the two sides from 1/16" sheet balsa with the grain running lengthwise from F-1 back to the tail. The grain runs vertically from F-1 to the nose. This joining of opposing sheets is necessary because the nose curves to quite an extent.

Cut out the formers from 1/16" and 1/8" sheet as called for on the plans, and join them together with the 1/8" sq. longerons, making sure that they dry at the correct angle. With the sides cut to shape cement them to formers F-1 and F-2 for initial alignment. When dry bring the rear of the fuselage sides together and glue. Apply cement to the longerons between F-1 and F-2, and between F-2 and F-3. Trace the top of the nose section from F-1 forward and cut from 3/32" sheet. Since the bottom piece is curved as well as slanted up, it is foreshortened on the plan, so it will be necessary to make this section 1/8" longer than shown. Before mounting the top nose cover, cut out a piece of hard balsa 1/8" by 3/4" for reinforcement of the motor mount. Be sure to cut the slit in both it and the fuselage nose section in order for the motor mount to slip firmly in place when the time comes for mounting. Bend and cement the sides of the nose to the fuselage top. The bottom of the nose section runs from the motor mount to the nose and is glued in place at this time.

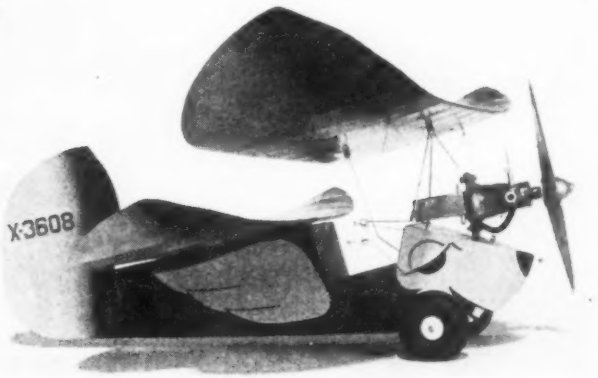
A straight piece of .040 steel wire is cut off for the landing gear. Bind and cement the landing gear to a piece of hard 1/8" x 1/4" x 2-5/16" balsa. Now cut a notch 1/16" deep for the landing gear to fit up into the fuselage sides and glue the whole assembly in place. Don't spare the glue here. A washer slipped over the axles and cemented to the fuselage will help to secure it.

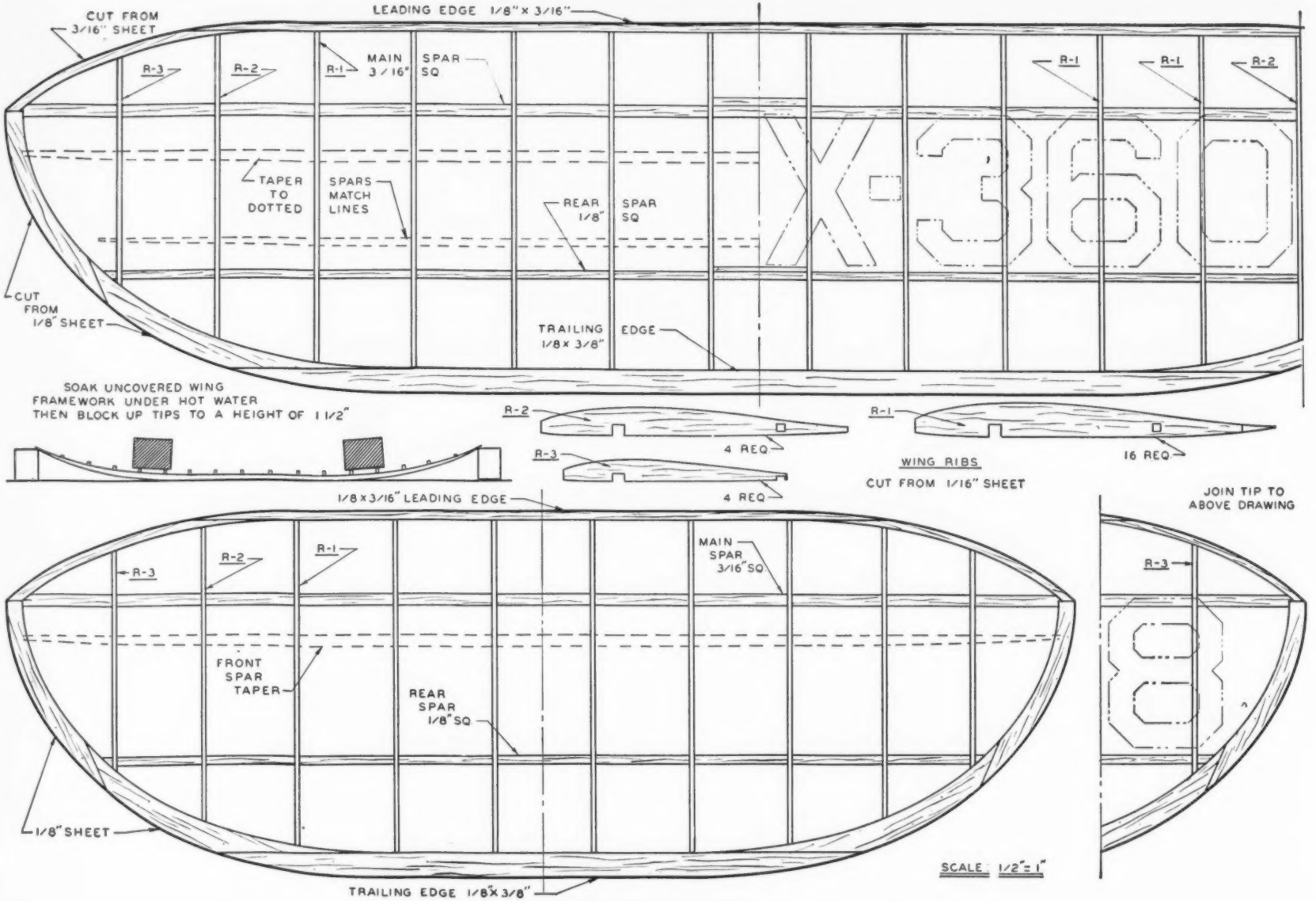
The wing mount braces are bent from 1/16" diameter steel wire, making sure to bend them to the correct angle as seen on the side view of the drawings. The main brace is first wrapped with thread all along the parts which extend into the fuselage. This wrapping allows the glue to hold it securely as it can't when applied to a metal surface only. Apply a liberal amount of glue to the wrapped portion and also to the curve of the fuselage at F-1 and slip this wing mount in place.

While drying, cut out the motor mount of 1/8" plywood with the main grain running lengthwise, and drill the two holes for mounting the motor. Cement this mount into the slot at the fuselage nose section. For extra reinforcement where it connects at the bottom of the fuselage, glue in a couple of 1/8" x 1/4" strips crosswise.

Cut out the bellcrank and mount to former F-1. After this has been accomplished you may cement the remaining portion of the fuselage bottom. Cover the top of the fuselage and bottom of the nose sections with 1/16" sheet with the grain running crosswise.

(*Turn to page* 50)

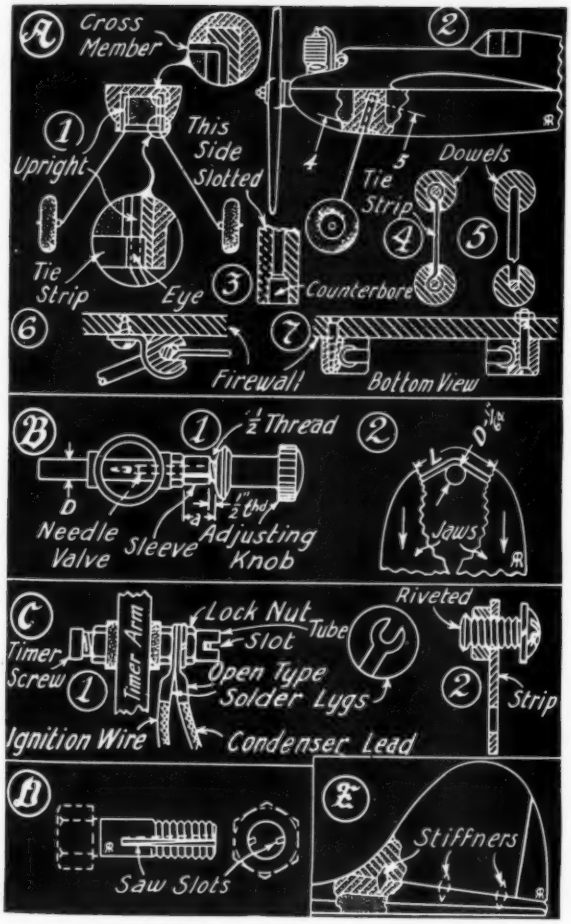



CUT FROM 3/16" SHEET
LEADING EDGE 1/8" x 3/16"
R-3
R-2
R-1
MAIN SPAR 3/16" SQ
R-1
R-1
R-2
TAPER TO DOTTED
SPARS MATCH LINES
REAR SPAR 1/8" SQ
X-360
CUT FROM 1/8" SHEET
TRAILING EDGE 1/8 x 3/8"
SOAK UNCOVERED WING FRAMEWORK UNDER HOT WATER THEN BLOCK UP TIPS TO A HEIGHT OF 1 1/2"
R-2
4 REQ
R-1
16 REQ
R-3
4 REQ
WING RIBS
CUT FROM 1/16" SHEET
JOIN TIP TO ABOVE DRAWING
1/8 x 3/16" LEADING EDGE
R-3
R-2
R-1
MAIN SPAR 3/16" SQ
FRONT SPAR TAPER
REAR SPAR 1/8" SQ
1/8" SHEET
TRAILING EDGE 1/8" x 3/8"
SCALE: 1/2" = 1"

# Modeling Kinks

by RAY RUSHER

**Here are some tricks to make model work easier for you**




A—SLIP-IN LANDING GEAR. Many model planes are so constructed as to have the wing and stabilizer removable for compact disposition in a carrying case. The landing gear can also easily be made removable. Simple arrangements using screws or bolts to rigidly secure the gear to the fuselage can be devised, but one that merely slips into position when you are ready to fly is the most desirable. Here's one that can be slipped in or out as desired yet will not fall out during take-off, flying or landing. It is particularly adapted to carved fuselages, types such as the *Fireball U-Control* plane, but can be readily adapted to other types also.

Form the landing gear wire as in Drawings 1 and 2, and tie the uprights together with a strip of tin soldered to the uprights after being wrapped around them. Bore holes the size of the landing gear wires in the exact center of two dowels. This is best done while rotating the dowels in a lathe and holding the drill stationary in the tailstock which insures that the hole will be parallel to the outer surface of the dowel. Counterbore the lower ends of the holes about 1/32" larger in diameter as shown in Drawing 3 to receive the eyes on the ends of the tie strip as in Drawing 4. Then cut the holes in the dowels out to one side as shown at 4 and 5 so that the landing gear can be slipped in or out.

The holes in the fuselage to receive the dowels are drilled the proper distance apart and the fuselage cut out between the holes to permit entry of the cross member at the upper ends of the uprights. The dowels are cemented in the fuselage holes with the landing gear in place in order to properly locate them in respect to each other. Careful work should result in a good tight friction fit. If the fit is a little sloppy, bend the uprights so they are slightly curved and the desired friction can be had.

On built-up types of fuselages, the dowels can be secured to a firewall or bulkhead of plywood by means of metal clips and screws as at 6, or by screws or bolts directly as at 7. The latter drawing also shows strips of hardwood of rectangular cross section instead of round dowels.

B—NEEDLE VALVE ADJUSTING SLEEVE. For normal running many engines require three to six turns of the needle valve from fully closed position. It is rather bothersome to adjust the needle valve due to having to turn it all the way down and then back it off the required number of turns. An easily constructed means to eliminate this inconvenience is to provide a "minimum adjustment" sleeve as shown in Drawing 1.

To determine the length of the sleeve, find the best operating position of the needle valve and measure the distance *a*. Then make the sleeve one-half thread less in length (1/64" on a needle valve body threaded 32 to the inch). The sleeve is made of a rectangular piece of tin or aluminum having a width equal to *a* minus 1/2 thread, and a length (L) equal to $\frac{21D}{7} + 2t$, *t* being the thickness of the piece. Bend the piece U-shape, and then graps it with the jaws of a pair of pliers as in Drawing 2, and pull it around a rod in the direction of the arrows. The rod is held in a vise and is slightly smaller in diameter than the needle valve.

The sleeve is slipped over the needle valve before the valve is inserted. When starting the engine the needle valve need now be opened only about one turn. After the engine is warmed up the needle valve is closed about one-half turn, and this leaves a half turn for leaning the fuel mixture as engine run-in progresses. Later, if the mixture needs to be leaned out to a point where the sleeve is too long (as after the engine is completely run-in and no longer stiff), it is a simple matter to remove it and shorten it by filing or grinding.

C—TIMER TERMINALS. Most timers have a stationary contact screw mounted on a timer arm or in a timer casing by means of nuts on the screw. The ignition wire to the timer is then connected with the screw by a solder lug surrounding the screw and held in position by a lock nut. The lock nut is quite often difficult to get at and is usually loosened and tightened with a pair of pliers which soon chews the corners off.

A handy special lock nut as shown in Drawing 1 can be made from a 1/8" or 1/4" length of brass tube soldered to the lock nut and provided in its outer end with a screw driver slot. To eliminate having to remove the lock nut when disconnecting the ignition wire and the condenser lead, use the open type of solder lug. This will facilitate removing the engine or changing the condenser when desired.

Another arrangement is shown at 2; a strip of brass or bronze is used, having a hole in the lower end to attach it to the timer screw with the original lock nut. A similar nut is soldered to the other end of the strip to receive a screw. A washer is placed on the screw, and the screw is then threaded into this nut to clamp the solder lugs of the ignition and condenser leads in place. The screw is about two or three threads longer than necessary to accommodate the lugs and riveted on the end to prevent loss of the screw, yet permit sufficient loosening to free the lugs when desired.

The strip can be made of such length and shape as to position the screw at a more convenient location than the timer screw, which in some installations is relatively inaccessible, without removing the entire engine from the fuselage. Lock washers are recommended to prevent accidental loosening of the electrical connections. Enough trouble is had with ignition systems, without inviting the possibility of loosening of screw-type connections.

D—SPARK PLUG WASHERS. The usual spark plug washer is made of sheet copper with an asbestos insert for resiliency. It becomes so flattened after the wrench has been used to tighten the spark plug a few times that it loses its resiliency and doesn't seal as well as when first installed. Another bothersome

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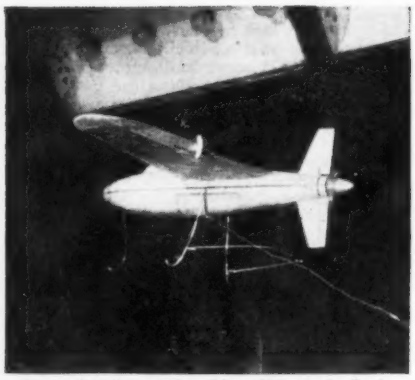


Powered tailless pusher "flying" in N. A. C. A. Free Flight Tunnel to study stability problems

PART TWO

# Longitudinal Stability

by **R. G. NAUGLE**

WE closed our discussion last month with a few notes on flying wing stability. Now, what about a conventional airplane with two "wings"—one behind the other? The stability picture, in elementary form, is merely "doubled" (Fig. 5). When the combination strikes a gust, an increase in lift occurs on the wing, $\triangle L_W$, and another increase in lift acts on the tail, $\triangle L_T$. The amount of lift increase in each case depends on the respective lift-curve of the surface and is in addition to the original wing lift $L_W$ and tail lift $L_T$, which maintained the model in a balanced condition with the moment about the C.G. zero. That is, when it was in trim. If the net result of these lift increases creates a moment about the C.G., which acts in such a way as to return the model to its original state of trim and to its original angle-of-attack, then the model is stable. This will happen *if the resultant R of these two increases in lift acts behind the C.G.* (Fig. 5). If it does, then the angle-of-attack will be reduced, the increases in lift caused by the gust, $\triangle L_W$ and $\triangle L_T$, will be reduced to zero, leaving only the original lifts, $L_W$ and $L_T$, acting as trim forces. This point, where the resultant of the lift *increases* R acts is then the "neutral-point" (N.P.)—or "point of zero or neutral stability" and is identical in concept to the aerodynamic center of the flying-wing. *In a sense then, it is merely the average location of the aerodynamic centers of the wing and tail.*

Since stability depends on the location of the neutral-point it is necessary to analyze the factors that locate it within the model. If the C.G. is located reasonably near the aerodynamic-center (which is customary) the location of the neutral-point then depends largely on the tail—its geometry and aerodynamic characteristics.

First of all, we see that increasing the tail length—that is, increasing the dimension B in Fig. 5— automatically moves the neutral-point *back* from the C.G. and so increases stability. Conversely, moving the wing forward in relation to the C.G. moves the neutral-point forward *towards* the C.G., reduces the static-margin, and so decreases the stability.

Second, in talking about increases in wing and tail *forces*, we can say that such forces are the equivalent of the wing or tail *area* multiplied by the increase in lift *per sq. ft.* Obviously then, if the *area* of the tail is increased, the tail lift will be greater and the neutral-point will be moved back. Conversely, if the wing *area* is increased, the neutral-point moves forward and the stability is reduced.

As for the amount of lift increase per sq. ft., this depends on the *slope* or *steepness* of the lift-curve; and this in turn depends directly on the aspect-ratio which is a geometric characteristic and is equal to $(\text{span})^2/(\text{area})$. For each aspect-ratio there is a definite lift-curve slope and this slope increases with aspect-ratio.

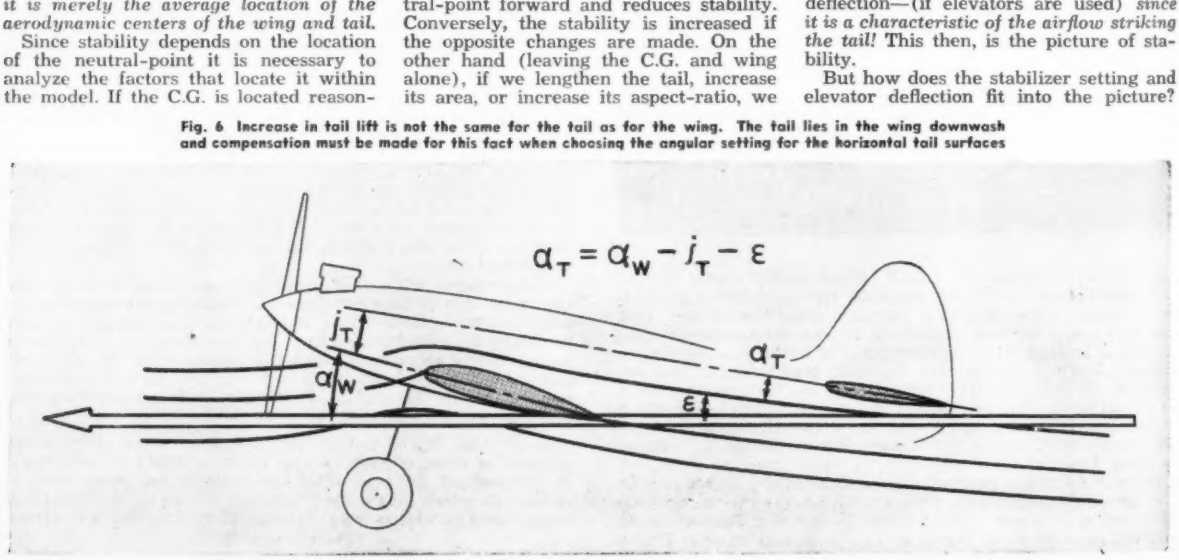
In summing up then (leaving the C.G. and tail alone), we can say that moving the wing forward, increasing its area, or increasing its aspect-ratio moves the neutral-point forward and reduces stability. Conversely, the stability is increased if the opposite changes are made. On the other hand (leaving the C.G. and wing alone), if we lengthen the tail, increase its area, or increase its aspect-ratio, we increase the stability while opposite changes reduce it.

However, another factor enters into the tail's ability to stabilize, since the slope of the tail's lift-curve is artificially reduced when we place the tail-surface downstream behind the wing. The combination of wing and tail together is not at all the same as when we have two individual, *isolated* wings. Obviously, the lift of the tail and everything that happens to it depends on the *local* airflow at the tail (and the *local* angle-of-attack)—*and this is very much different from that of the wing!* If the angle-of-attack of the wing is, say 5°, the angle-of-attack of the tail is NOT 5°. This is an extremely important consideration in longitudinal stability.

The front wing deflects the air downward by an angle called the "downwash angle," which increases at a constant rate with the wing's angle-of-attack. The tail must constantly fly in this deflected airflow (Fig. 6). Consequently, the actual angle-of-attack of the tail, $\alpha T$, *is always less* than the wing's angle-of-attack, $\alpha_W$, by the angle of downwash, $\epsilon$—and is usually about one-half the wing angle-of-attack depending on the location of the tail. Consequently, the slope of the tail's lift-curve and the tail's contribution to the stability of the model is only about one-half that which would be expected from its area and aspect-ratio. This is true, of course, regardless of the stabilizer setting on the fuselage or of the elevator deflection—(if elevators are used) *since it is a characteristic of the airflow striking the tail!* This then, is the picture of stability.

But how does the stabilizer setting and elevator deflection fit into the picture?

**Fig. 6 Increase in tail lift is not the same for the tail as for the wing. The tail lies in the wing downwash and compensation must be made for this fact when choosing the angular setting for the horizontal tail surfaces**



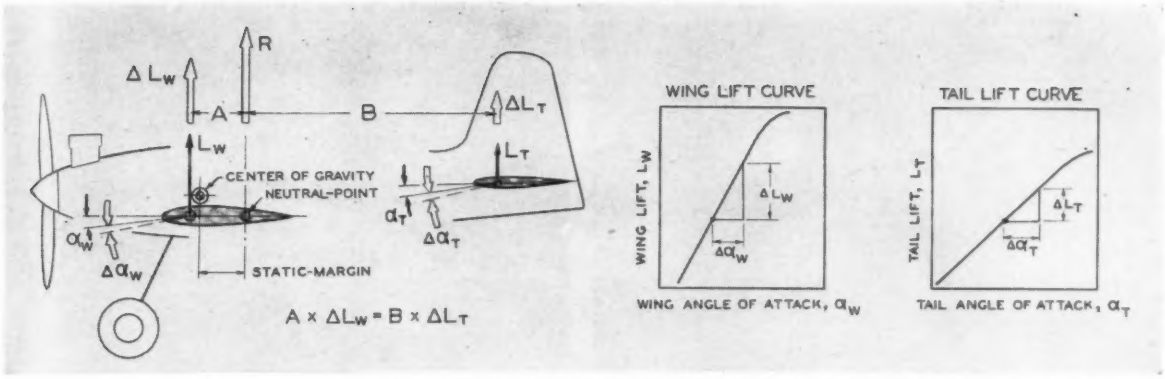



**Fig. 5 Change in wing and tail lifts, when a gust strikes the model. Nomenclature is listed herewith:**

**αw—Original angle of attack of wing at trim**
**Δαw—Increase in wing angle of attack due to gust**
**Lw—Original wing lift at trim**
**Δ Lw—Increase in wing lift due to gust**
**αT—Original angle of attack of tail at trim**
**Δ αT—Increase in tail angle of attack due to gust**
**LT—Original tail lift at trim**
**Δ LT—Increase in tail lift due to gust**
**R—Resultant of wing lift increase and tail lift increase acting at neutral-point of model**

There has been much argument about this but it is quite simple when we remember that it is the *slope* of the lift-curve that is important to stability.

Looking at the tail's lift-curve, we can quickly see what we do when we deflect the elevator or reset the stabilizer in reference to the wing. When we set the stabilizer at some angle to the wing, we merely subtract the angle of tail-setting, $i_T$, and the downwash angle, $\epsilon$, from the wing angle-of-attack, $\alpha_w$, to get the actual angle-of-attack of the tail, $\alpha_T$. Consequently, when we change the stabilizer setting we simply shift the tail lift-curve *sideways to the right or left* by adding or subtracting an *angle* equal to the change in tail-setting, and form a series of parallel lift-curves, *all with the same slope.*

As for elevator deflection, the effect of moving the elevators is merely to shift the lift-curve *up or down;* that is, we simply add or subtract *lift* and form a series of parallel lift-curves, one lift-curve for each elevator deflection (Fig. 8). *However, in all cases, the lift curves are straight lines and have the same slope!* Consequently, we see that any change in angle-of-attack of the tail caused by a gust always *changes* the lift on the tail by exactly the same amount, *regardless of tail setting or elevator deflection!* Neither of these factors then, can have anything to do with stability. The stability will always be the same as long as the lift curves remain straight and parallel. Being straight, of course, merely means that the tail surface isn't stalling out, while the slope itself, as we have said, is a function only of the tail's aspect-ratio. Thus we see that the neutral-point and the stability of a model is a built-in characteristic and can't be changed by adjusting the tail. Only by moving the C.G. can we change the stability of a *given* model, moving it forward to increase the static-margin and the stability and moving it rearward to reduce it—just as we did on the stick, the spear, and the arrow previously mentioned. Adjusting the tail angle, naturally changes the *trim,* and the speed and attitude at which the model flies.

What connection is there between stability and control? Well, stability, in the physical sense, can be described as the inherent reluctance of the model to rotate or change its angle-of-attack for *any* reason. Consequently, when we wish to purposely rotate it—to change its angle-of-attack, and have it climb or dive—we have to overcome this inherent reluctance. Therefore, if the stability is large it takes more control effort and more elevator deflection to change its flight attitude than when the stability is small. Since elevator deflection is identical to stabilizer setting as far as tail lift goes, then we can also say that it takes more change in stabilizer setting to trim, retrim, or control a highly stable model than it does a slightly stable one. Therefore, we can also say, in reverse fashion, *that when we have a large amount of stability in a model, it means that the actual setting of the stabilizer is less sensitive to secure proper trim.*

When the stability and the static-margin is small, a model can be trimmed for a wide range of flight attitudes and angles of climb with only a small change in stabilizer setting. For example, if the static-margin is small, say 5% MAC, perhaps a change of only 1° in stabilizer setting will change the trim speed from level flight so much that the model will hang on its prop in a vertical climb. If the static-margin is about 15% MAC, however, perhaps a 10° change in stabilizer setting would be necessary.

In fact, test pilots of actual airplanes find the neutral-point of an airplane by simply flying it at several C.G. locations and noting how much elevator deflection is required to change the angle-of-attack a certain amount. By moving the C.G. to the rear, this amount of elevator deflection required becomes less and less. Finally a rearward C.G. location is reached where no movement of the elevator is required to change the attitude of the airplane (it is then neutrally stable) and this C.G. location is the neutral-point of the airplane. To have positive stability, the C.G. must always be forward of this point.

A large amount of stability then, is a highly desirable characteristic in a model airplane since it allows steadier flights, less sensitive stabilizer settings, less sensitive elevator control and less change from power-on to power-off flight. But, stability is a *built-in* characteristic that can be changed in a *given* model only by moving the C.G. It has nothing to do with tail setting or elevator deflection—that is a matter of trim and control, of providing the right tail load to balance the model, so the resultant of all forces acting on the model equals zero about the C.G. The distance from the C.G. that the resultant of the *increases* in lift (and other forces) due to a gust acts, however, is a measure of the *stability.*

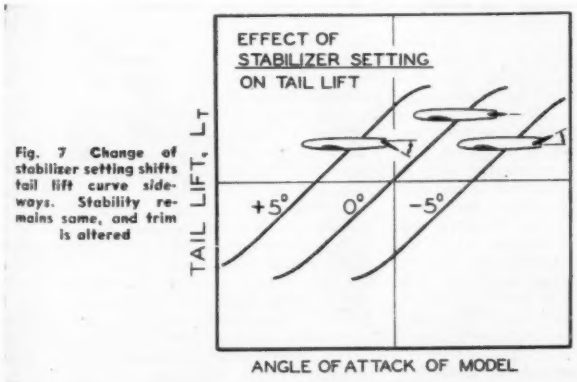



**Fig. 7 Change of stabilizer setting shifts tail lift curve sideways. Stability remains same, and trim is altered**

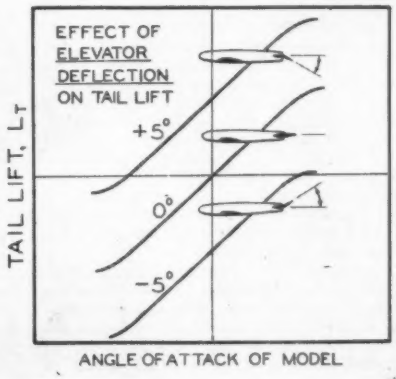
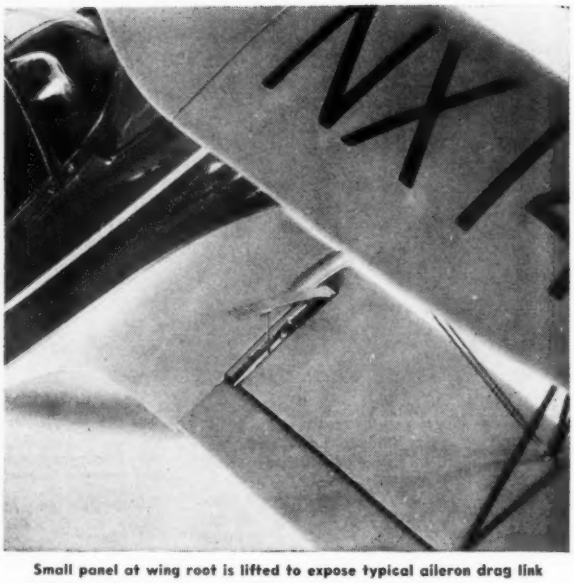



**Fig. 8 Deflecting elevators shifts tail lift curve up or down. Slope of curve and consequently stability is unchanged**

Note the exact scale strut and rigging fittings apparent in this view



Small panel at wing root is lifted to expose typical aileron drag link

# Fitting Features

**FREDERIC K. HOWARD**

TO what extent should a scale model correspond to the detailed plans of the actual airplane? The question is answered in one way or another by every scale model. The solid model offers one answer, the detailed type another. But with a few possible exceptions, even the most intricate model falls short of complete duplication of every feature found on the model's prototype. In the type of miniature known as the detailed scale model, a distinction is usually made between those features visible on the completed model and those that are not, and an attempt is made to include as many of the former as possible. This is a practical compromise since over-all realism ordinarily remains unaffected by out-of-sight features.

Since scale drawings relate to the airplane and not to the model, even the drawings of William Wylam cannot tell the modeler how to construct the various intricate parts he decides are required. The problem of visualizing the features shown in the drawings in terms of the materials and facilities the modeler has available is left, as it should be, entirely to each individual builder. If the scale drawings show only the construction details of the full size feature, there is no necessity to interpret this as meaning that no other method of representation can be used. Ordinarily, the rigging, the control system, or any other feature can be built in miniature in a number of different ways. In every case though, the construction method used on the actual airplane must be understood before any modified method better suited to the builder's facilities can be devised.

When a scale feature is modified in design or construction, scale deviation often is involved and, although inaccuracies of this nature are commonly discouraged, the truth is that the majority of detailed models deviate from scale in some respects. On the better models these scale inaccuracies are either out of sight or very inconspicuous. They occur not from carelessness or for reasons of convenience but only because the exact duplication is impractical due to limitations of scale or of materials. They are deliberate, not accidental. Scale deviations are decided upon only if an advantage in realism results. For example, the scale of a model may prohibit the construction of an operating control system unless certain parts, ordinarily not visible, are built oversize. In this case, if the control system is used, the gain in realism appears well worth a few out-of-sight scale inaccuracies. The average conscientious modeler is apt to demand that retractable gears retract, moveable surfaces move, and rigging wires rig. If the various systems to achieve this necessitate a few scale deviations not normally visible on the finished model, he considers it still worth while. This view is probably not in the best scale model tradition but it has a definite practical appeal. As a compromise it fits the tools, materials and skills the average modeler has available.

If this policy is adopted, the first job for the builder, after a thorough study of the drawings of the original part or system is to redraw the system, incorporating all modifications required for his particular model. This must be done with careful regard for the materials and tools the builder expects to use. The sketches shown typify this kind of drawing, the purpose of which is to relate the system or part to the model materials available for its construction. The drawings illustrate, for example, a type of strut and rigging wire arrangement that might be adaptable to many scale biplane models. The sizes of the materials used for this type of feature depend on the scale of the model and upon the size of the struts and rigging wires on the actual airplane. Ordinarily, the arrangement suggested can be varied to minimize and conceal scale inaccuracies. The greatest difficulty in building detachable landing and flying wires that actually rig the wing panels is the determination of the exact length for each rigging wire. Since the wires ("plug fitted" within the strut sockets) are, unlike the real rigging wires, non-adjustable, each separate wire must be precisely the correct length. The easiest solution is to rig the model completely with ordinary round-section wires and use these as measures for the proper length of the oval-section rigging. (Tinned wire available in various sizes at hardware stores, can be shaped to oval section by flattening in a metal vice or by careful hammering followed by sanding or filing to the desired section.)

Scale inaccuracy is ordinarily confined to certain details the dimensions of which, if built for the usual scale model, are generally impractical. As an example, consider a control system and the problems usually encountered in designing and installing in the typical model. The requirement in this case is that the controls in the cabin or cockpit operate the surfaces in the same manner as found in the airplane. The first difficulty is invariably scale requirements, for the majority of models are built to a scale of one inch or less to one foot—a scale resulting in models of 25 to 50" span depending on the aircraft type. On this basis it may be required to construct a ball and socket joint within a diameter of 1/32 to 1/16". Or, the various links in the full size system may be pinned using 3/16" aircraft bolts—thus requiring 1/64" dia. metal "bolts" in the model system. The average builder simply lacks the equipment to work materials precisely at these small dimensions. The control system parts which ordinarily are impractical to hold to scale are chiefly the bearing surfaces and the metal pins holding the linkage together. Other parts —control sticks, push rods, or torque tubes—can usually be duplicated to scale without much difficulty.

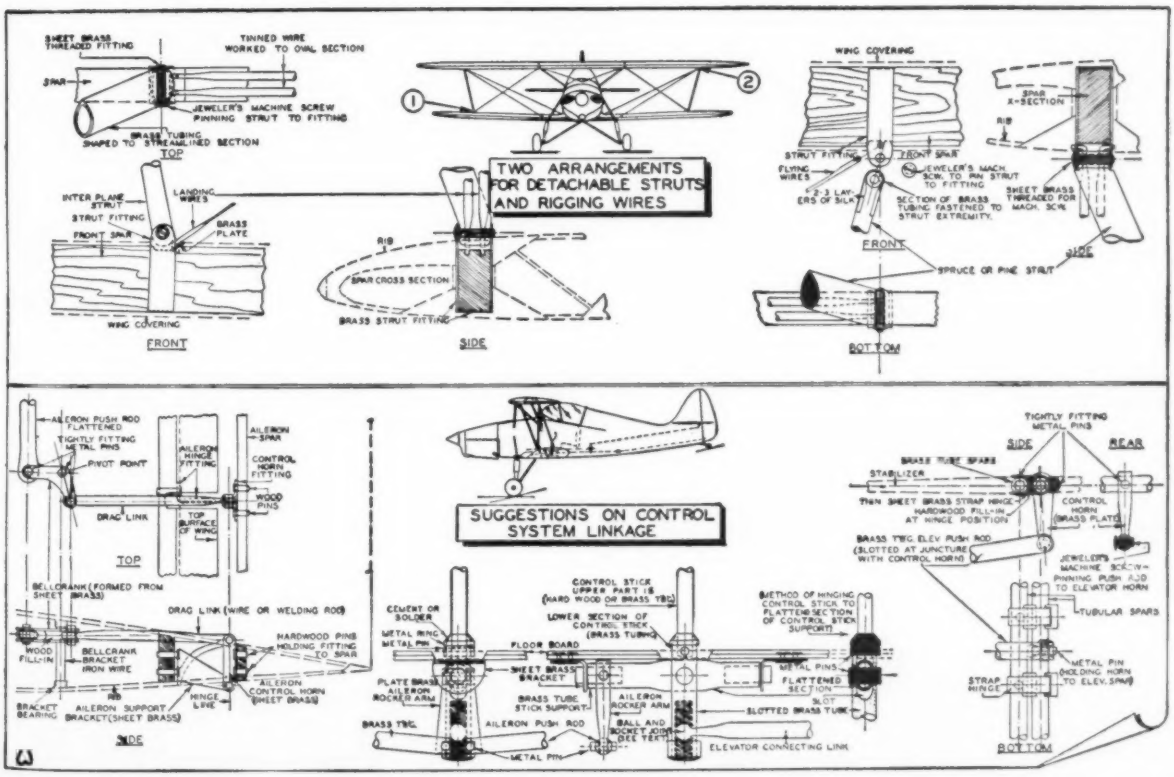
In the accompanying drawings the control system shown is not a scale representation of any particular full size system. Rather, it shows the relative sizes of model materials commonly available that may be used in operating scale model control systems. For example, if a model were built to a scale of 1″ to 1′ using the system shown, the relative sizes of the various materials would be as follows: the upper part of the control stick—1/16″ dia. (3/4″ dia. on the actual airplane); lower section of control stick—3/32″ O.D., 1/16″ I.D. brass tubing; control stick support (to which the stick is hinged)—3/32″ O.D., 1/16″ I.D. brass tubing; aileron and elevator push rods—1/16″ O.D. brass tubing; elevator horn and aileron rocker arm —.05 brass plate; sheet brass fittings of .005 to .010 thickness and metal pins of 1/32″ dia. The average scale modeler can work materials of these dimensions with considerable accuracy. If the scale of the model is less than 1″ to 1′, sizes smaller than those listed are required; if the scale of the model is greater than 1″ to 1′, larger sizes of the same or similar materials are appropriate. Thus in deciding the scale for a model featuring an operating control system it is worth while to consider the types and sizes of materials available.

Another problem occurring as the model control system is modified from the full size control system is the choice of suitable joints. The policy of "simplifying" the system by substituting a pin joint for a universal or ball and socket joint and hoping that the "slack" in the system will permit smooth operation simply does not work. The various joints are determined by the motion the particular parts involved must have and the original control system is always built with simplicity as a design factor. There is rarely room for improvement. One common trouble spot in model systems is the connection of control stick to elevator push rod. In the majority of recent or modern airplanes the stick is connected by a rod to a rocker arm arrangement which in turn actuates the flippers by push rod or control cables. Unless the cables run directly to the control stick, thereby eliminating any connection of control stick to connecting or push rod, the motion of the stick dictates a swivel connection at the juncture of stick and push rod. Neither a simple pin joint nor universal joint permit the motion the control stick must describe. Of the various swivel joints that may be devised, the ball and socket type is often the most satisfactory. One method of constructing this type is suggested in the accompanying drawings. The elevator connecting link which attaches to the control stick is constructed from soft iron wire or welding rod. The diameter of the wire should be the same as or slightly greater than the diameter of the ball to be formed on the end of the wire link. If the inside diameter of the brass tubing into which the ball must fit is 1/16″, the iron wire used must be 1/16″ or slightly larger in diameter. The ball itself is shaped by working carefully with fine files and emery paper. It looks difficult but a reasonably accurate sphere with diameter just fitting the tubing is actually fairly simple to shape. The part of the wire connecting rod extending through the wall of the brass tubing should be about 1/3 the diameter of the rod. At the point where the rod is to extend through the wall of the tubing (on the lower section of the control stick in the drawing shown) a hole should be drilled and reamed such that the joint when completed will not bind the free movement of the control stick. The ball is placed in the socket by splitting the tubing from the lower end to the hole drilled for the projection of the connecting rod through the tubing wall. Two sections of hard wood dowling (cup shaped at the ends which are to be against the ball) form the socket within the brass tubing. These sections should be a force fit in the tubing. A small section of concentric tubing fitting over the bottom of the lower section of the control stick insures that the split tubing will retain its original diameter. Ball and socket joints of this type have been constructed in various sizes for different control systems with no evidence of play developing. They are a useful type of joint but their construction as outlined ordinarily is out of scale. Consequently, they can be recommended only for those control system parts which are not visible on the completed model.

On some airplanes the ball and socket joint is used in connecting the aileron drag link to the aileron horn. (The Waco *Taper-Wing, Commandaire,* and several other American designs of the 1930's featured this arrangement.) Since the mechanism is clearly visible it would be undesirable to use an out-of-scale joint for such a model part. The joint for the aileron drag linkage (the unit which connects, through a bellcrank, the aileron push rod to the aileron control horn) may, as illustrated, be a simple pin joint assembly. However, since the motion of the aileron horn and the bellcrank (the two parts which the drag link connects) is in different planes, a non-swiveling universal joint is sometimes employed. If a simple pin joint is used, care must be taken that the holes drilled in the drag link for the pins are reamed. (Of greater diameter at the outer edges than in the middle of the hole.)

In constructing an aileron control mechanism special attention should be paid to the aileron hinge arrangement. Frequently, the hinge line is on or below the lower surface of the aileron and considerably back from the aileron's leading edge. The purpose of this balanced aileron

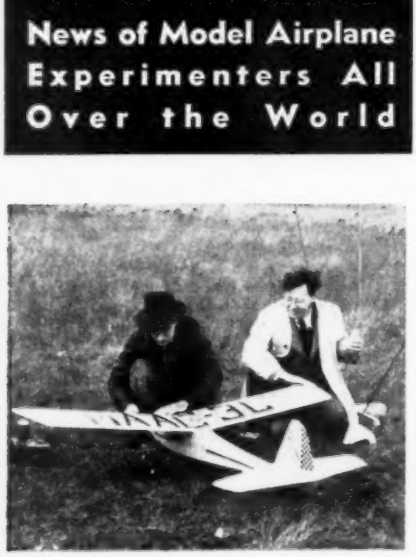
(*Turn to page* 52)



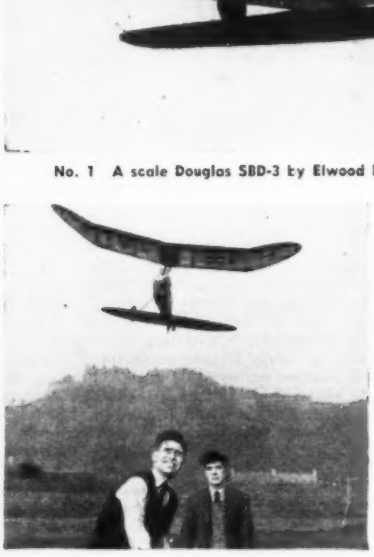
# AIR WAYS

**News of Model Airplane Experimenters All Over the World**

No. 1 A scale Douglas SBD-3 by Elwood L. Jerome that is *really* true to scale

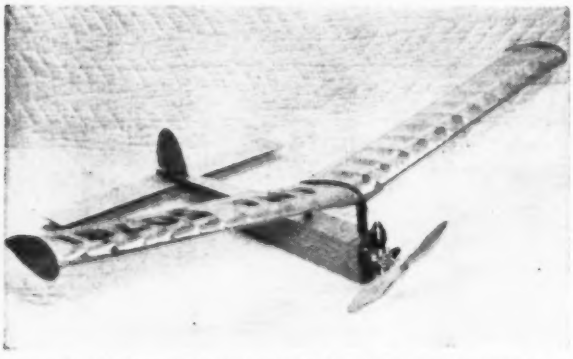


No. 2 Bruce Lester & Bert Beasley with R. C. Job



No. 3 Al Lamb gets his diesel ship away

No. 4 *Ginger Snap* and builder Che Shu Kee



No. 5 *Infant*-powered original design flown by Thomas A. Dietrich

No. 6 Unusual scale U-liner. L. W. Christensen built this German B. V. 141

RADIO CONTROL FLYING has reached a new high in interest and activity this season, but contests for R.C. flying are still few and far between. Aside from the Nationals and the Mirror Model Flying Fair on Long Island, at both of which radio flying has regularly been featured, we have received official news of only two other R. C. events. This is a pretty poor showing. From dozens of inquiries received at our offices from modelers interested in this form of activity, we *know* the interest is there. It just needs a little prodding to get the boys into action.

Perhaps the prizes offered for R. C. events are not sufficient. Whereas a modeler will gladly risk a gassie which cost him perhaps $15, including motor, kit, timer, etc., in the hopes of winning a $10 motor, let's remember that the R. C. builder has a minimum of about $35 tied up in his ship, even if he makes the radio equipment himself. If he is flying a dual channel ship with commercial apparatus, his investment may be over $100. Would *you* risk this for a doubtful prize motor, or a inexpensive trophy?

Meet sponsors will immediately say that better R. C. prizes will put their costs up too high, but we feel certain the strong additional publicity attendant upon a well-advertised R. C. event will more than offset the extra prize cost through larger entries in other events, more interest from the general public and hence better concession sales, and so on.

There is something about R. C. flying that captures the imagination and interest of the model builder and the uninitiated spectator alike—just unpack a R. C. ship from your car at any model flying site and you'll see what we mean! Why not develop this interest and give serious model flying a boost at *your* next meet?

WE TAKE PLEASURE in reporting details received from various clubs of methods used to pep up their meetings. Latest item in this category comes from John Acker, Jr., of the *Inglewood Flightmasters*. He writes that at one meeting four *Infant Powerhouses* were built, to be flown against each other over the following week end. He notes that such an airplane can be completed by four or five builders working together in a very short time.

At another meeting, members built up three rubber kit models, and real excitement ensued when the competing groups of builders pitted their efforts against one another on the flying field.

The usual practice is to present these models to the younger and inexperienced builders after the contests, Thus such ships furnish the whole club with a lot of fun, then continue the good work by en-

couraging some young member in their modeling activities.

TRIM THE FIN. Further intensive test flying with the *Goosey Gander*, presented in our July issue, has brought to light the possibility of sharp right turns or dives, under certain conditions. If your model behaves in this manner, the cure is simply to reduce the size of the vertical tail fin. Trim a strip 1/2" wide from the leading edge. If this does not afford a complete cure, cut off 1/4" more, or a total of 3/4" in all.

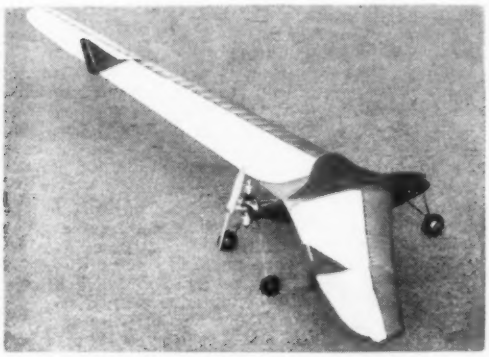
• •

Our first model this month is a really exact scale job of the Douglas SBD-3, built by Elwood L. Jerome (2907 Bayview Drive, Apt. A, Manhattan Beach, California). Mr. Jerome is an engineer for the Douglas Company, and needless to say, he is interested predominantly in their products. This model was built from authentic factory plans and has a complete scale cockpit. The guns, which are not visible in the photo, are equipped with cartridge cases; the ship has sliding hatches and dive brakes as well as a dummy bomb, all of which are workable. Wingspan is 37" and the model is powered with a *McCoy 35*, carrying a remotely controlled electrical retractable landing gear. Although the ship is a bit heavy for speed or stunt flying, the ample wing area makes it a good flier.

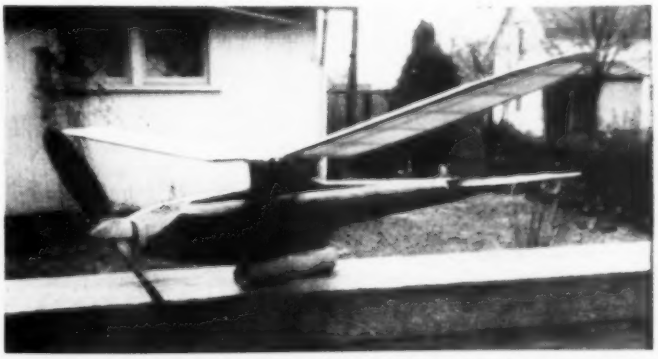
Bruce Lester (254 Glen Park Avenue, Toronto, Ontario, Canada), director of public relations for the M.A.A.C., has become interested in radio control flying and sent us photo 2 of his new ship designed for this purpose. The ship is powered by an *Ohlsson 60* which is on its side so that the adjustment for sidethrust is very easy. The wingspan is 6', with a modified Clark Y airfoil. Bruce takes care of the airplane design and flight problems while his partner, Bert Beasley, is the radio expert on the project. Like other modelers who have tackled this type of flying, Bruce finds R. C. not as simple as it looks. He writes, "When you read it out of a magazine, it's a cinch, but the 'worm turns' when you actually take a crack at radio controlled flight."

Good shots of models in flight are rather rare, and we are very pleased to reproduce picture 3 which shows Al Lamb (Two Sutherland Avenue, Stirling, Scotland) launching his model. The ship itself should be familiar to American readers of M. A. N. since it is a copy of the *Gnat* by Claude McCullough. Mr. Lamb uses a 0.1 cc *Frog 100* diesel for power and has had exceptionally fine results from this airplane, with which he has taken several places already in con-

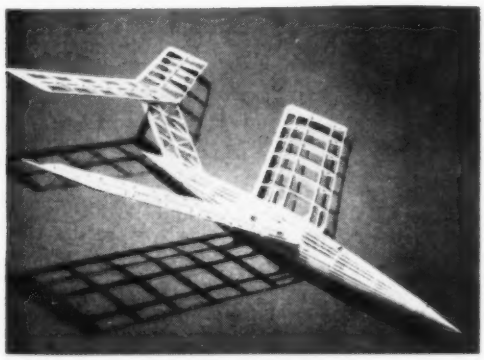
(*Turn to page* 40)



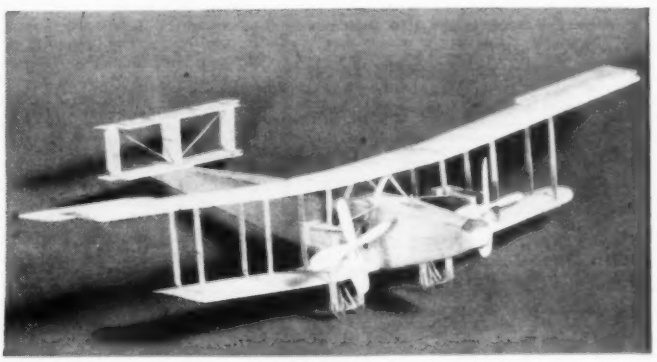
No. 7 50" span—*Infant* power! By Leonard Savastio



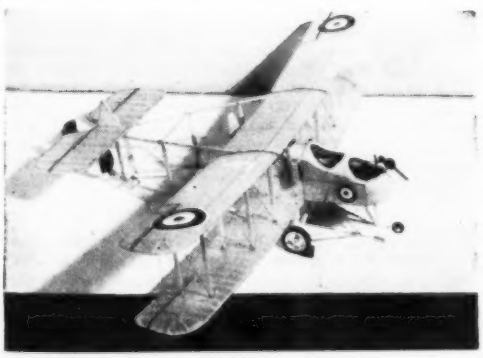
No. 8 Jato for rubber models! Stan Helsmann fitted small rocket on 20" ship



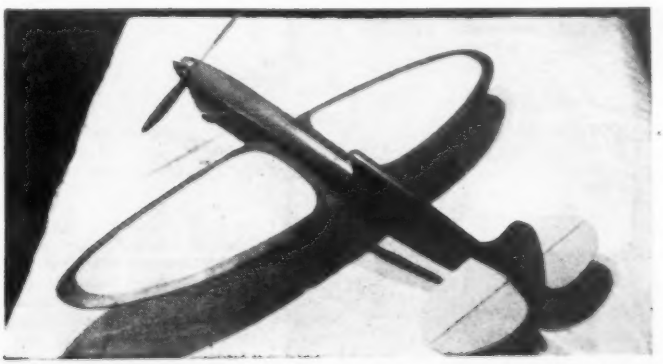
No. 9 Guy Ramaekers built this "super-sonic glider" framework



No. 10 Rubber-powered Handley-Page bomber by Calmer and Schulke has drive trouble



No. 11 K. Middleton, a World War I fan, built this FE-2B



No. 12 Very attractive stunt ship which will do any maneuver Ralph Yount desires

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For all around superior performance
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10" dia. - 9" pitch
11" dia. - 9" pitch
12" dia. - 9" pitch
8" dia. - 11" pitch
9" dia. - 11" pitch
10" dia. - 11" pitch
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## Design Forum

(*Continued from page* 13)

run into the danger of spiral instability. There is a happy medium. The wing will be properly located if the lower surface of the center section is above the thrust line a distance equal to one half the wing chord, as in Fig. 1.

You will note in Fig. 1, that a moderately low C.L.A. is achieved by means of panels of balsa wood between the wire struts of the landing gear. Another feature which has the effect of lowering the fin area and increasing the angle of attack for both wing and stabilizer during climb, is the attitude of the thrust line, T. L., and it should be drawn as shown, approximately through the center of fin area. With this general setup your airplane will not only be efficient aerodynamically but will be super stable under all conditions of flight, that is, whether it is climbing, flying horizontally, banking, turning, etc. Basically this results because the axis of roll which passes through the forward and rearward centers of lateral area, (F) and (R), is approximately parallel to the thrust line.

Many ships with a high C.L.A. actually obtain high performance, strangely enough, because of the high location of this point. However, what many model builders overlook is that with a high C.L.A. such planes are *stable under certain conditions* and *unstable under other conditions* of flight. Consequently, such planes can be made to perform well *provided* design factors are injected which cause the plane to perform in such a way that it follows only the favorable flight conditions. For instance, the high pylon (high C.L.A.) model gains its excellent performance because it is made to climb with the nose *pointed upward continuously until the motor cuts.* With a high C.L.A. it spirals, so when the nose points upward, it spirals upward. If for any reason this model assumes horizontal flight position and receives a sudden side gust which veers it to the left, it will go into a tight spiral dive.

The vital factor in this design is therefore to locate the pull of the propeller well below the line of resistance (Figs. 1 and 2) so that a sharp nosing up tendency will be induced during the entire period of climb. On the other hand, if the C.L.A. is located low as in Fig. 1, with the line of resistance above the thrust line, the model will climb sharply but *without spiraling.* The climb will be nearly straight but steady and we believe the highest altitude will be obtained through this type of performance rather than wasting power through a spiral climb.

The model in Fig. 1 may be constructed very easily. The wing may be of orthodox rib and spar design with polyhedral or it may be a balsa sheet with ribs glued to the under surface of the upper sheet. The under surface may be covered also with balsa sheet or with paper. The fuselage may be of standard longeron and strut square frame work, covered with paper or with thin balsa sheet; 1/32" stock is recommended. Similar construction may be used in the stabilizer. This surface may even consist of a simple sheet of balsa. The fin also can be of a sheet of balsa; the pylon can be a built-up framework covered with silk, or it can be made of balsa. It is important that 1/16" balsa sheet be cemented between the front and rear struts of the right and left landing gear. Do not expect your model to perform as steadily if these panels are omitted. They serve to keep the center of lateral area low. Without them the model will have more tendency to spiral.

Mr. Chuck Braun was intrigued with the Canard pusher described in Fig. 4, January, 1949, "*Design Forum.*" He built a gas model with this configuration and powered it with a .099 engine. It had 350 sq. in. of wing area and weighed 18 oz. While testing it, he ran into a very important point. Though the ship climbed at about 70° and veered neither left nor right, it whipped into a vicious flat spin as soon as the power cut, a reaction common in Canard (tail forward) planes. It is the result of the center of lateral area being forward of the center of gravity as in Fig. 3. The plane performed well during climb because the rotational action of the propeller gives the effect of fin area—in this case, at the rear. This brought the *EFFECTIVE* center of lateral area rearward of the center of gravity. However, when the propeller stopped, the true structural center of lateral area moved forward of the center of gravity. Consequently, when the plane veered slightly during glide, a resultant side pressure was created forward of the center of gravity which tended to make the plane veer even more sharply. These two reactions each increased the effect of the other, instead of reducing it, so the plane continued in the tight spiral to the ground.

Mr. Braun discovered the cure for this condition, diagnosing the trouble as we have stated it here. He placed two fins on the wing, on each side of the center one-half way to the tips, which brought the center of lateral area *rearward* and subsequent flights were perfect in all respects. As Mr. Braun suggests, it is well to cut down the side area forward of the center of gravity in Canard designs. In fact, the most difficult design problem in such planes is to provide sufficient area at the rear without the necessity of adding fin area and useless weight. It is most efficient to work out an arrangement that naturally provides fin area at the rear rather than at the front. The amount of fin area required is governed largely by the position of the center of gravity, or C.G., which should be as far forward as possible. In other words, instead of moving the C.L.A. rearward the same effect can be obtained by moving the C.G. forward. The further forward this latter point is, the less fin area will be required at the rear.

This brings up an objection to the design shown in Fig. 3, in which the motor and its weight is at the rear of the airplane. In such cases the center of gravity is either too far rearward or it is necessary to make the forward part of the airplane excessively heavy to bring the center of gravity forward to a convenient position. Of course, heavy structure forward increases the structural weight of the airplane unnecessarily. Placing the motor at the nose brings the center of gravity too far forward. In fact, it is then so far forward of the resultant center of lift of the wing that the plane will not fly. Consequently, the logical and best position for the motor in the Canard plane is between the two wings as in Fig. 4.

Here we have a problem of structural arrangement. There must be a structure extending from the rear to the forward wing so that these two surfaces will be held in their proper position relative to one another. But with the propeller in the position between the wings, the frame

(*Turn to page* 36)

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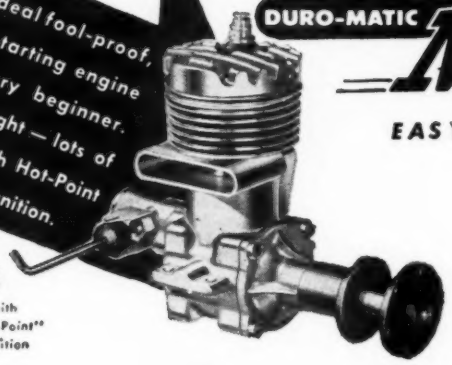

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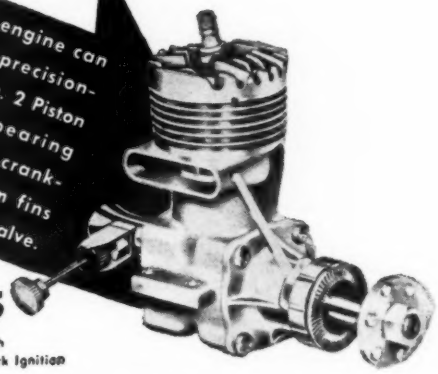

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**EXCUSE, PLEASE!**

**As noted in the July issue, the article on a *Supermarine* S-4 controliner was scheduled for this August issue. Last minute production difficulties, however, delayed the article so long that it had to be omitted. You will find it in our September issue. (This is a promise!)**


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or fuselage structure must extend around the propeller arc. Fig. 4 shows one method that may be used. Another method is to build two slim fuselages or booms extending from the rear wing forward to the front, one on each side of the propeller arc. The engine may be mounted at the nose of a center nacelle, attached to the center of the main wing. The latter arrangement is very neat, except it makes it inconvenient for take-off and land. Such a plane requires a long landing gear to prevent the propeller from striking the ground. In this latter respect the design shown in Fig. 4 is more convenient. Here only one boom or fuselage is necessary. However, upward extensions from each end of this boom are required to mount the rearward and forward wings. The wheels may be attached directly to the bottom of the fuselage without long struts. It is a question which design is superior.

This may also answer several points in Mr. Paul Marino's letter. He also has been experimenting with Canards and, like others, he finds that in most cases their flying qualities surpass tractors and that they do not have many of the unstable characteristics of tractors. With a little research and development this type of plane can readily surpass any tractor model and it is most interesting because it presents a challenge to modellers of scientific mind to solve the design problems and bring this type of plane to a high and efficient state of development.

For twenty years the author experimented intensively with Canard models and several tricks of design were worked out which resulted in greater stability and steadiness of climb and flight. The most important is to raise the front wing above the thrust line wherever possible, and thus provide a high line of resistance which may be utilized to induce nosing up or climbing angle under power instead of setting the front wing at a large angle of attack. There need be only a difference of 2° between the front and rear wings in such cases.

The ideal situation from an efficiency standpoint is where both wings are set at the same angle. However, this would produce no longitudinal stability or difference in trim at different airplane speeds. The front wing must be located or set at such an angle that the plane noses up at increase in speed and down under decrease in speed. This prevents stalling and causes a tendency to nose down as the angle of climb increases, thus preventing stalling. In other words, the effect of locating the front wing high has the same effect as increasing its angle of attack, without decreasing its efficiency.

Another trick is to make the front wing with at least twice the dihedral as the rear wing. About 9° is suggested for the rear wing and 20° for the front wing. An elevation of each wing tip of 1" when the *total span* is 12" gives a dihedral of 9° on each *half wing*. For a 2' span each wing tip should be raised 2", and the front wing would then have an over-all dihedral of approximately 20°. Large dihedral reduces the front wing lifting effect at slow speed. Consequently, the steeper the angle of climb and the slower the plane flies, the less lift the front wing will give. This produces an automatic tendency to reduce the angle of climb as the stalling point is approached. This naturally causes an airplane to level off again. Planes with this feature were flown some years ago in the New England Championships in a 30- to 40-mile wind, and were among the 5 or 6 out of a field of 100 that did not crack up due to the wind.

## Vixen

(*Continued from page* 17)

sition to this, but after a season's flying our club is for them 100% and wouldn't think of switching back to ignition and the attendant multiplicity of things to go wrong. That first knotty problem—the effect of the fuels on finish—is now out of the way with the new finishes, cements, and dopes that are impervious to hot stuff.

The wing and tail are of dependable Goldberg multi-spar construction and all details relative to their construction appear on the plans. The dihedral should be installed in the wing before the leading edge planking is applied.

The dethermalizer pivot block is made from soft pine and cemented in place. An aluminum bracket at the rear of the elevator, with a hole to pass the timer pull rod, is securely fastened in place. A guide tab at the front part of the elevator prevents it from sliding or twisting when released. The pressure of the rubber bands must be kept light or there will be an undue amount of friction acting on the timer pull rod and cause its operation to be erratic. If your tail does not pop up satisfactorily when the timer releases, try adding a small rubber pull band on the leading edge of the rudder about a third of the way up and running it down to the fuselage. This gives a little starting inertia to get the tail started up. A piece of kite string is used to keep it from popping up too high; an angle of around 40 to 45° is generally considered best, but you can experiment with the angle if you think the ship is coming down too fast or at too steep an angle.

The original ship was covered with silk that had been dyed. If you don't care for silk, GM silkspan or Jap tissue will be satisfactory. The front part of the plane should be finished in a hot-fuel proof paint to prevent the fuel from deteriorating the cement and covering. You can get by quite well with only this amount of protection if you are careful not to spill the raw fuel around on the plane. If you want more total protection, try one of the clear varnish finishes, such as *Seal-Sure*. The places most affected usually are the areas around the motor and tank, and the side and half of the stab in the exhaust stream. The wing seldom has any contact with fuel in concentrated enough form to harm ordinary clear dope.

One objection that many fliers have to glow plugs in free flight ships is that you can't satisfactorily throttle down the motor to make test flights. To me, this is no objection because I have long thought the throttled-down motor is no way to make a test flight that will prove anything. Instead I use full power or fairly near full power and keep the motor run short—about 3-1/2 to 4 sec. A pylon ship always begins to climb and gain altitude before beginning to wind in under a maladjustment. I have never had a ship yet that was so seriously off keel that the motor did not cut before the ship was still a safe distance from the ground, even in a downward spiral. I have seen many builders make several flights successfully with throttled down motor and then raise it to 3/4 and then give it full power. On the full power flight the ship almost always shows different characteristics than it did on the others, and often with disastrous results. So I'll stick to my guns and say that if you really want to find out what the ship is doing, rev it up to at least 3/4 throttle. Most pylon ships fly best on right turn under power and left turn in the glide. If you prefer a tight circle in the

(*Turn to page* 38)

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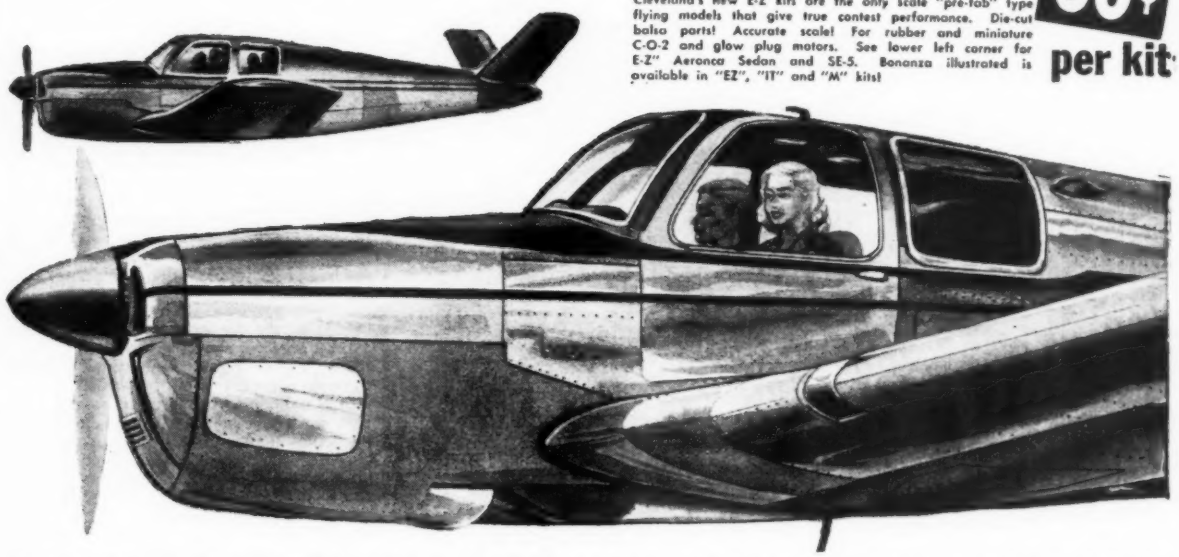

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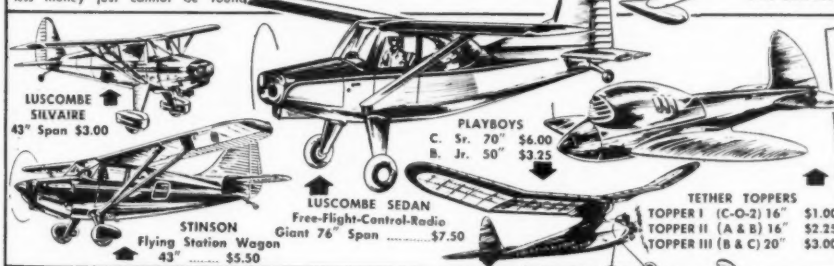


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| 1/8 x 3/8 | .03 |
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| 1½ x 2 | .59 | .42 | .13 |
| 2 x 2 | .70 | .45 | .26 |
| 2 x 3 | 1.15 | .81 | .44 |
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| 1/8 | .11 | .16 | .26 | .56 |
| 5/32 | .12 | .17 | .28 | .61 |
| 3/16 | .13 | .19 | .31 | .64 |
| 1/4 | .15 | .23 | .36 | .70 |
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glide, it is almost a certainty that you will have to put right thrust in the motor.

All the removable surfaces should be securely keyed to the parts that they attach against so that once the adjustment is secured it may be kept. This business of adjustment the morning of every meet will sooner or later catch up with you and leave you nothing but a basketful of scraps. Even with permanent adjustments, a check flight is still advisable because of that possibility of a little warp, but at least the whole routine will not be necessary.

Incidentally, we'd like to say a word on landing gears. Originally we toyed with a one wheel pop-up design. But no matter how well you get them working, 9 out of 10 is about the best average of good take-offs you can expect. And that tenth one is at the big contest where you can least afford poor results. So on the *Vixen*, after starting fancy we ended plain, and have indicated a simple two wheel gear which will give you a good take-off when the contest director should require. A wrinkled prune to all those responsible for off-again on-again ROG rules. They should either be off or on, preferably off. Or even more preferably, leave it to the contestant as in the proposed rule for 20 second motor run ROG, or 15 sec. hand launch. Those that hand launch would have to take a few seconds penalty and those ROGing would get a few seconds advantage. But neither would be the victim of the occasional contest director who likes to see a model graveyard at the end of his inadequate runway.

Remember our moral on dethermalizers, because the *Vixen* romps off in a thermal at the slightest opportunity.

## World War I

(*Continued from page* 19)

airspeed indicator and basic engine instruments. In spite of their appearance in the infancy of military aviation, the Roland C.II's were equipped with radio for artillery spotting, and the observed controlled a trailing antennae which he reeled in manually after use.

The observer also was equipped with the only machine gun on the plane—a parabellum air-cooled weapon—mounted on a revolving ring. Shells were fed to the gun by means of a cloth belt wound on a replaceable reel.

As the C.II got into service, the inevitable happened to it, either the German Air Force or individual pilots embellished it with more equipment. The Government added bomb racks and interior equipment but did nothing about armament. Individual pilots relocated supplementary equipment such as rear-view mirrors to suit their whims or style of flying, and it is a matter of photographic record, that captured British Lewis machine guns were mounted atop the overturn structure to provide a forward firing weapon. This was before two-seaters were equipped with synchronized machine guns!

Landing gear of the Roland C.II consisted of the usual four struts of streamlined steel tubing, attached to fittings bolted to block reinforcements built into the fuselage structure.

Another of Roland's problems was providing an engine radiator system worthy of the streamlined theme of the C.II. Radiator style of the time was merely to hang one out in the slipstream where it would get plenty of breeze. The popular (later) German airfoil type radiator had not been developed at that time, so engineer Roland did the next best thing

with the technology possessed by component suppliers at the time. He had designed and built for the C.II "form-fitting" radiators what maintained the contour of the fuselage where they were installed. A normal water cooling radiator was attached to the left side of the fuselage under the upper wing, and an oil cooling radiator, about half the size, was fitted on the right side. These are visible in the illustrations we have printed of the Roland C.II.

FLIGHT SURFACES. The Roland was an unusual airplane for its time in that, as a two-seater, it had only one set of interplane struts on each pair of wing panels, right and left. These members followed the advanced engineering and aerodynamic thought found throughout the airplane. Each strut had a basic structure of steel tubing in the form of a capital "I", with the top and bottom cross bars curved and angle-braced for rigidity. This tubular framework was then covered with plywood.

The wings themselves were equal in span and chord, composed of two main spars situated close together to which were attached the ribs. Each upper and lower panel contained 13 full ribs with nose ribs in between to maintain the entering edge airfoil. Ribs were plywood webbed with vertical reinforcements and gussets glued and tacked in place for added strength.

Leading edges were rounded and hollowed spruce, with combination wood and metal tubing wingtips. Trailing edge was wire, backed up by a spanwise intercostal fitted between the upper and lower capstrips. Three steel tubing compression members were provided for each upper and lower left- and right-hand panel.

Unbalanced ailerons were fitted to the upper wing only and were framed with steel tubing tip and aft, with wood ribs and leading edge. They were operated by a quadrant on the hinge line attached to control wires running through the lower wing.

The Roland C.II empennage was entirely conventional. Early C.II's had a triangular right- and left-hand horizontal stabilizer, but this was later changed to an over-all trapezoidal form. Tests conducted to prove the need of this change were carried out in "nature's wind-tunnel"—an early C.II was set on a test stand built on a railroad flat car. The train was then run down a long straight-away at "high" speed, but in spite of the crudeness of the tests, they pointed the way to an increase in horizontal stabilizer area, and the application of results proved the answer to one of the C.II's early control problems.

Structure of both horizontal and vertical stabilizing members was wood with fabric cover, and that of the elevators and rudder was steel tubing and fabric.

Early Roland C.II's were painted an over-all silver. Insignia were placed on a white square background. For some unexplainable reason, there was no type identification on any part of any early airplane. Perhaps such information may have been obliterated by the silver paint; then again, such details may have been thought of as "comfort to the enemy" and omitted purposely.

Whatever the reason, it cannot be denied that the Roland C.II was, from the standpoint of design at least, one of the "hottest" ships of the early World War I period, and probably an inspiration to designers of all nations. That it was not a more outstanding success was perhaps the result of a practical dreamer being too far ahead of reality.


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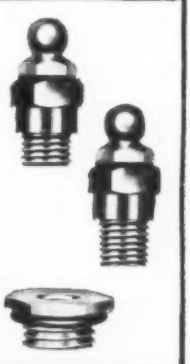

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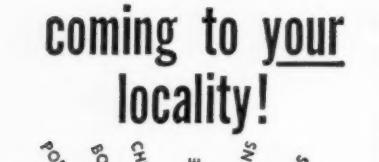

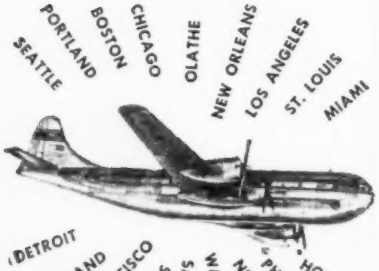


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## Air Ways

(*Continued from page 33*)

test flying. He is secretary of the *Stirling Model Flying Club* and offers us news of modeling in Scotland, which we will be very glad to print in MODEL AIRPLANE NEWS whenever he sends it in.

Another M. A. N. design, this time built way over in China, is reproduced in photo 4. Here we see Che Shu Kee (Five Bonham Road, Hong Kong, China) holding his model of the *Ginger Snap* which he has powered with an English *E. D. Mark II* diesel. He notes that the combination is a very successful flier.

No. 5 shows a representative of the increasingly popular midget class of models. Thomas A. Dietrich (P. O. Box 505, Burlington, Vermont) built this original design. It has an all balsa fuselage and tail assembly, with a tissue-covered wing. Complete weight is slightly over 2 oz. The power plant in the photo is a *K & B Infant* and the model was one of those which flew right off the drawing board. Recently a *K Hawk* .22 cc diesel was tried out in this model and it, too, gave excellent flights with a tight spiral climb and flat glide. Design features include wingtip plates, a post-type pylon mount, and a Grant X8 airfoil.

The model in picture 6 looks like something you might see in a bad dream. It is, however, an exact scale copy of a German observation plane flown during the recent war. The ship is the Blohm-Voss 141, and this model made by L. W. Christensen (518 East 134th Street, Hawthorne, California) has already won several contest awards. The frame is built up, with the surfaces either planked or covered with sheet balsa. This unusual model is powered with a glow plug *Torpedo Special* and weighs 2 lb.

A unique example of obtaining the most out of a tiny power plant appears in No. 7. The flying wing was built by Leonard A. Savastio (Price Hall, Lehigh University, Bethlehem, Pennsylvania). The model has a span of 50", and an *Infant* engine flies it satisfactorily. Actually the ship is a sailplane, modified by the addition of a detachable motor unit. Mr. Savastio notes that the wing has made occasional good flights, but at other times it veers off sharply to the right or left. In his opinion, this is indicative of lateral instability.

A novel experiment in the application of rocket power to assist a model in obtaining altitude quickly is illustrated in photo 8. This is a brainchild of Stanley H. Heismann (8701 Winton Road, Cincinnati 24, Ohio) and was an experiment to determine possibilities of this arrangement for a future gas and rocket combination free flighter. Stanley notes that present-day gas engines don't actually *need* a rocket boost to get the ship aloft in a hurry, but he admits he gets a big thrill from this combination. The Jato units are simply small sky rockets with a stick removed. After lighting the fuse, the model shown is hand launched and flies along on rubber power until the rocket fuel ignites; then abruptly the ship heads skyward in a zooming climb. The duration of this rapid climb is, of course, quite short, but nevertheless it affords a big thrill!

The framework in No. 9 is not the prototype for a new jet fighter! Mr. Guy Ramaekers (31-35 Felix Marchal Avenue, Brussels IV, Belgium) tells us this is a design for a "super-sonic glider." The wing has a span of 36" and uses one of the English laminar model sections, called LDC2. When Mr. Ramaekers wrote us,


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**MAYFLY**

**A number of readers expressed great interest in the scale model, photos of which were used to illustrate the article *Material Matters* in the April, 1949, issue. Author Howard was persuaded to work up complete plans of the ship which he calls *Mayfly*. If you want to build a super-detailed scale model, watch for the article on *Mayfly* in the September issue.**

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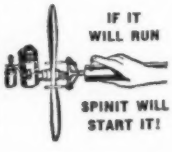


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the ship had not been completed as yet, so we don't know how the performance will be. The builder, incidentally, is one of the most prominent Belgium modelers and writes that he would like very much to exchange books and model materials with builders in the United States.

An all balsa scale WWI plane, built by Ed Calmer (4179 West 226 Street, Fairview Park, Ohio) and Dick Schulke is shown in picture 10. This is a Handley-Page 0/400, and the drawings were made up entirely from specifications and photos in one of Bob Hare's articles in MODEL AIRPLANE NEWS. As may be seen, the model is made entirely of sheet balsa, and as an experiment the builders tried to power it by transferring energy from a rubber motor in the fuselage to the propellers in the nacelles, by means of pulleys and elastic cords. This arrangement was not too successful because of the slippage of the driving system, so the model has been shelved and will be powered later with two *Campus A-100* engines. The wingspan is 18" and the model has proved to have a very nice flat glide, with stable characteristics in general. Incidentally, the props shown in the photograph are made of very stiff paper. These have been found to be very efficient when used with CO2 engines.

Another World War I scale job is shown in picture 11. This ship is the FE-2B and was constructed by Kendall Middleton (no address received). The body is covered with sheet balsa and molded with plastic rock. The wings have a total of 93 ribs and are covered with tissue paper.

Our final photo shows a very able stunt model, an original design built by Ralph Yount (173 Waverley Street, Palo Alto, California). It is powered by a *Madewell* engine and has a wingspan of 40". Total wing area is 280 sq. in. Top speed on 65' lines is about 82 mph, using an 11-6 *Top Flite* prop. Apparently the ship is a great success as Mr. Yount writes it will perform any stunt in the A.M.A. pattern.

## NEWS OF MODELERS

*In this column we publish the names and addresses of readers (most of them from overseas) who write us that they are anxious to contact American modelers. Some seek a pen-pal; others wish to exchange a foreign jet or diesel for an American engine; some would like to exchange magazines, plans, etc. You will find it very interesting to select one or two names and start a correspondence with these fellow modelers.*

PEN-PAL SEEKERS: Andrew C. Burston, 23 Montalto Avenue, Toorak, S. E. 2, Victoria, Australia . . . Ralph Langley, P. O. Box 38, Naauwpoort, Cape Province, South Africa . . . E. Lund-Nielsen, Davids Alle 9, Karby, Aalborg, Denmark . . . Bob Rodwell, 72 Northumberland Park, Tottenham, London, N. 17, England . . . Roland Cledes, Professeur centre artisana, Lucq de Bearn, Basses Pyrenees, France . . . Floyd Carter, 9632 San Vincente, South Gate, California . . . C. Chamberlin, 23 Keithlands Avenue, Norton, Stockton-on-Tees, Co. Durham, England.

EXCHANGE MOTORS: E. A. Dorne, 83 Jersey Road, Hounstan, Middlesex, England . . . Dixon B. Ashman, 42 Whithouse Street, Middlesbrough, Yorks, England . . . M. S. Collier, A.C. II, 2359955, HUT 145, West Camp, S. H. Q. R. A. F., Cranwell, Nr. Sleaford, Lincs, England.

EXCHANGE MAGAZINES, PLANS, ETC.: T. Wooldridge, 17 Womersley Road, Plumstead Est, Norwich, England . . . Helmut Braun, 20b Braunschweig-Sud, Lindenberg 8, British Zone, Germany.

SPECIAL REQUESTS: Joaquin Ramos G., Calle 63 No. 472, Merida, Yucatan, Mexico, would like to contact a German modeler and his letters can be written in Spanish, German, or English.

## CLUB NEWS

### Arizona

Here are the results of the recent 4th Annual Arizona State Championship contest. *Free Flight Gas* ½*A*—John Fong; *A*—Bob Brawner; *B*—David Nelson; *C* & *D*—Jack Wolfe; *Rubber Power Cabin* & *Stick*—Check Sutton; *Stunt*—Roy Robbinson; *Speed A* & *B*—Jim McElroy; *C*—Ed Bolbin; *D*—Jim McElroy; *Team*—Don Jacobs.

### California

Mal Alberts, the first secretary of the *Los Angeles Sod Busters*, wrote us recently about the new club, which has only been in existence six months. In January there were 7 charter members; now there are 19. Future plans call for an Invitational Free Flight Meet some time in September. At the present time all their energy is being spent on the Wakefield Event which is quite popular in Los Angeles.

Howard G. Puckett, Editor of WEST COAST MODEL NEWS commented in his column "Prop Wash" of the May issue: "The NEW YORK MIRROR is a Hearst publication . . . There are Hearst publications here on the West Coast . . . Why


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**T. H. G. Says—**
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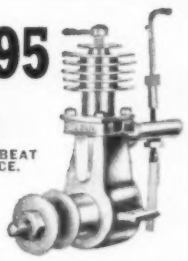

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**COMET**

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is it that we can't have an EXAMINER FLYING FAIR? Could it be the EXAMINER doesn't even know we have model airplanes on the West Coast? Could it be the confusion created by always changing rules, and whims of the modelers themselves? Or is it the definite lack of cooperation shown by DEALERS in the failure of every 'Dealers Association' ever formed here."

### Colorado

Several months ago, the *Radio Control Modelers*, of Denver, or *Flying Sparks* as they sometimes call themselves, was formed by "a group of confused model airplane enthusiasts" with the idea of trying to clear up some of the confusion by exchanging information on radio control. To date, they have 25 members and 6 R.C. ships under construction. Since their regular meeting place is the ballroom of the Windsor Hotel, they have taken up indoor rubber and microfilm flying in the ballroom on meeting nights. It is their idea that this type of flying will sustain interest in the club during the winter months when they can't fly radio control.

### Maine

The *Waterville Flying Aces* now report a membership of 23, about half which are Junior members. They plan to compete in all of the contests held in the state.

### Massachusetts

A new club has been organized—the *Andover Air-Istocrats*. Bob Bachmann is president, Frank Wright, sec.-treas, and publicity man is Walter Leonhardt. The *Air-Istocrats* do not specialize in any particular branch of modeling.

### New York

The 4th Annual Air Show and Model Flying Fair, sponsored by the NEW YORK MIRROR, was held (for a change!) to the accompaniment of exceptional weather at the Grumman Airfield, Bethpage, Long Island, on June 6. Many thousands of spectators watched the modelers go through their paces and later were treated to an Air Show put on by the government services. During the flying show, records were checked and preparations made for awarding the prizes, which were even larger this year than they had been in 1948.

The Radio Control event, which is always included in MIRROR meets, was well attended this year and numerous official flights were turned in by the various contestants. The MODEL AIRPLANE NEWS trophy for first place in this event again was awarded to Fran McElwee (he won the R. C. trophy last year). The model he built especially for the MIRROR Meet was washed-out a few days before, and Fran entered the same ship with which he won the meet in 1948.

The Model Flying Fair also included "Class ½A" for the increasingly-popular miniature motors. This class was listed both in the Free Flight and Stunt divisions.

The 1st place winners are: *Radio Control*—Francis McElwee; *Jet Speed*—Alonzo Carver, Jr.; *Stunt Division*—Harold Reinhardt; *Speed Contest Class ½A*—Mike Jorda; *A*—Robert Rowe; *B*—John Pritchett; *C*—Joe Campione; *D*—Harold DeBolt; *Free Flight Class ½A*—Peter Asher; *A*—Carl Wheeley; *B*—Henry Schley; *C*—Ed Ritter; *D*—Aubrey Pearson; *Non-Scale Beauty*—Martin Lihel; *Scale Beauty*—John Janesex; *Grand Prize*—Michael Jordan; *Special Prize*—Kent Mercer.

## COMING CONTESTS

July 10, OHIO—Hamilton, 3rd Annual Meet, *Hamilton Prop Twisters.*
July 10, TENN.—Crossville, 4th Annual Volunteer State Free Flight Contest, Class AAA.
July 10, W. VA.—Huntington, *Huntington Propbusters* Controline Meet, Class AA.
July 10, N.Y.—Mamaroneck, *Airbusters Model Club*, 2d Annual AMA sanctioned contest.
July 10, PA.—Burgettstown, Hillman's Model Airport, *Pittsburgh Model Airplane Control-Liners*, Free Flight Duration & Precision, Type D.
July 10, CALIF.—Long Beach, *Long Beach Jr. Chamber of Commerce.*
July 10, CANADA—Ontario, 11th Annual International Model Aircraft Contest.
July 16, CANADA—Brantford, *Kloudsters of Brantford*, F.
July 16-17, TENN.—Knoxville, Annual KMAC Meet, all outdoor events, Class AAA.
July 16-17, MISS.—Laurel, Magnolia State Model Meet, R, F, CO2, G, U, S.
July 16-17, KY.—Louisville, *Louisville A. B. C. Model Club*, F, U.
July 17, N. Y.—Watertown, 5th Annual Northern N. Y. Outdoor Invitation Meet, Class AA, U, S, CO2, F, R.
July 17, PA.—Burgettstown, Hillman's Model Airport, *Pittsburgh Model Airplane Control-Liners, Precision.*
July 17, CANADA—Brantford, *Kloudsters of Brantford*, U.
July 18, ILL.—Chanute Field, Air Force Base Contest, AMA sanctioned, U.
July 24, PA.—Burgettstown, Hillman's Model Airport, *Pittsburgh Model Airplane Control-Liners*, Marathon Type M for first 2 hr.; exact duration rest of time. Type E.
July 26-31, KANSAS—Olathe, 18th National AMA Championship Meet, AAAA.
July 31, N. Y.—New Rochelle, Model Aero Meet, Class AA, U.
July 31, ORE.—Portland, 2d Annual Free Flight Contest, *Multnomah Doodlebugs.*
August 7, ARIZ.—Prescott, Northern Arizona Invitational Meet, Class AA, F, R.
August 7, OHIO—Cleveland, 2nd Annual CO2 Contest, Class AAA.
August 7, PA.—Burgettstown, Hillman's Model Airport, RC.
August 14, CALIF.—Milpitas, *San Francisco Vultures* Free Flight Gas Meet, Warm Springs Airport.
August 14, MONT.—Boulder, 1949 Model Airplane Controline Flying Circus, Class AA, sponsored by Boulder Athletic Club.
August 14, ILL.—Chicago, Class AA meet with U, Goodyear race events.
August 14, PA.—Burgettstown, Hillman's Model Airport, Duration and Precision flying.
August 21, N. Y.—Brooklyn, 6th Annual Free Flight Contest at Valley Stream, Long Island, (Old Curtiss Air Field), sponsored by *Brooklyn Sky-Scrapers.*
August 22-29, MICH.—Detroit, Plymouth International Meet.
August 28, PA.—Burgettstown, Hillman's Model Airport, Type D.
September 3, 4, 5, UTAH—Salt Lake City, 11th Annual Douglas Trophy Contest, AMA sanctioned.
September 4, FLA.—Jacksonville, 13th Annual Dixie State Contest, controline division.
September 4, PA.—Burgettstown, Hillman's Model Airport, Type M for 1st 2 hr.; Type E rest of time.
September 11, PA.—Burgettstown, Hillman's Model Airport, Team Competition.
September 18, PA.—Burgettstown, Hillman's Model Airport, RC.
September 18, ILL.—Chanute Field, Air Force Base Contest, AMA sanctioned, U.

U—Controline; F—Free Flight Gas; R—Free Flight rubber; G—Glider; RC—Radio Control; W—Water Events (ROW); S—Scale; I—Indoor.

### Ohio

A new club in Toledo has been organized—*Westol Hotrocks.* Meetings are held on Monday evenings from 8 to 10 p. m. in the back room of Hartman's Hobby Lobby, 2145 West Central Avenue, Toledo. Recently elected officers are: Pres., Jim Tyner; Sec. and Treas., Ted Rohweder; and Contest Directors, Don Belote and Ted Rohweder.

### Texas

Frank Schampel, Sec. of the *Magic Valley Modeleers*, sent us results of their Plymouth Model Airplane Meet held May 1 at Miller Municipal Airport, McAllen, in conjunction with the Sports and Hobby Festival. Here are the lucky winners: *Grand Champion*—Caesar Fulton; *Stunt*

(*Turn to page* 44)

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| New Era (B) | 3.95 | Demco Speedwagon (C-D) | 4.95 |
| Cessna 195 (B) | 4.95 | Demco Stuntwagon (D) | 7.50 |
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| Toggle Switch | 0.50 | Arden GlowPlug | 85c |
| Slide Switch | 0.30 | Control Wire, 100' 010, 012, 014 and 016, 140' | 50c 65c |
| Pee Wee Clips, ea. | 10c | | |
| Spark plugs, state size | 50c | Veco Air Wheels, per pair 2½" 2.15, 3½" 2.50, 4½" 2.75 | |
| Austin Timer | 1.50 | | |
| Battery Box, Lg., Med. or Sm. | 0.40 | Sponge Wheels, Alum. Hubs, ⅞" pr. 20c; 1⅜" pr. 30c; 1⅞" pr. 50c; 2⅜" pr. 60c. | |
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| Flexible Needle Valve | 1.25 | Fiotorque Props, 8"-14" | 35c |
| Neoprene Tubing, ft. | 25c | | |
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| Walker Remoto | 12.50 | Top Flite Props, 8 to 14" Dia., 3½" to 12" pitch | 35c |
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| Plywood Sheets, 3/32, ⅛, 3/16, ¼, 6"x 12" | 1/16, 35c | T-56 Brown Contest Rubber, ⅛x1/30 flat 1c ft., 3/16 x 1/30 flat 1½c ft., ¼ x 1/30 flat, 2c ft., 1 lb. spool $4.50. | |
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| 1/16x1/8 | 1c | 1/4 sq. | 3½c | | |
| 1/16x3/16 | 1½c | 1/4x3/8 | 4c | | |
| 1/16x1/4 | 2c | 1/4x1/2 | 6c | | |
| 1/16x3/8 | 2½c | 1/4x5/8 | 7c | | |
| 1/16x1/2 | 3c | 1/4x3/4 | 8c | | |
| 3/32 sq. | 1c | 5/16 sq. | 5c | | |
| 3/32x3/16 | 2c | 3/8 sq. | 6c | | |
| 3/32x1/4 | 2½c | 3/8x1/2 | 8c | | |
| 3/32x3/8 | 3c | 1/2 sq. | 9c | | |
| 3/32x1/2 | 3½c | 3/4 sq. | 15c | | |

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| 1/8x1/4 | 2½c | 1x6 | 1.10 |
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| 1/8x1/2 | 4c | 2x4 | 1.25 |
| 5/32 sq. | 1¼c | 2x6 | 1.80 |
| 3/16 sq. | 2c | 3x3 | 1.50 |
| 3/16x1/4 | 3c | 3x6 | 3.00 |
| 3/16x3/8 | 3½c | 4x4 | 3.50 |
| 3/16x1/2 | 5c | 4x6 | 4.25 |

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| 1/32x2 | 8c | | |
| 1/20x2 | 8c | | |
| 1/16x2 | 8c | | |
| 3/32x2 | 10c | | |
| 1/8x2 | 10c | | |
| 5/32x2 | 12c | | |
| 3/16x2 | 14c | | |
| 1/4x2 | 16c | | |
| 5/16x2 | 18c | | |
| 3/8x2 | 20c | | |
| 1/2x2 | 22c | | |
| 1/32x3 | 13c | | |
| 1/16x3 | 13c | | |
| 3/32x3 | 16c | | |
| 1/8x3 | 16c | | |
| 3/16x3 | 22c | | |
| 1/4x3 | 25c | | |
| 3/8x3 | 31c | | |
| 1/2x3 | 34c | | |

**Beveled balsa trailing edges, 36" lengths**

| | | | | | |
|---|---|---|---|---|---|
| 3/32x3/8 | 3c | 5/32x5/8 | 5c | 7/32x3/8 | 7c |
| 1/8x1/2 | 4c | 3/16x3/4 | 6c | 1/4x1 | 8c |

**Propeller Blocks**

| | | | | | |
|---|---|---|---|---|---|
| 8x7/8x1-3/16 | 6c | 1-3/4 | 18c | 18x1-3/4x2 | 32c |
| 10x1x1-1/2 | 10c | Glider Wing | | 9x1-1/2x2 | 15c |
| 12x1x1-1/2 | 12c | Section | | 10x2x2-1/4 | 25c |
| 14x1-3/16x | | 16x1-1/2x2 | 26c | 3x3/16x20 | 18c |

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### OFF THE BEATEN TRACK

**Are you in a rut? Bill Winter thinks many model builders are, and to stir them out of it, we will run his article "Off the Beaten Track," in which he suggests ideas for several unusual models and accessories, in the September issue. We hope this article, which is well illustrated by H. A. Thomas, will stimulate our readers to try some of the oddities presented.**


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#### England

R. H. Greaves, of the *South Birmingham Model Flying Club*, sent us the results of the Midland Area Rally, held recently at Walsall Airport. C. A. Threlfall came in first in the Power Ratio class with 75.52 ratio; his flight was for 15:6.25.

#### New Zealand

Here are the results of the *South Island Champs'* Contest held recently: *South Island Duration Trophy*—G. Dellow 4:16; *Open Rubber ROG*—D. Kennedy; 17:44; *Towline Glider*—L. E. Napper 3:33; *Glider H-L*—McAulay 4:15; *Spar H-L*—K. Lilley 4:27; *Wakefield (3 Flight Av.)*—D. Kennedy 1:40; *Gotch Precision Flight Trophy*—G. Gudsell 83 pts.; *Class A Speed*—M. McRorie 13.2; *Class B Speed*—A. Williams 8:47; *Gotch Direct Control Precision Flying*—W. E. McDonald—95 pts.; *Aerobatics*—C. Colson; *Club Trophy*—Dunedin 25 pts.

## Rebuild It?

(*Continued from page* 23)

the crankpin. It is fairly certain that the weight of this assembly will swing the shaft around until the pin is straight down. Now add the counterweighting; ideally it should be just a little too much. Next, by filing or grinding remove enough weight so that the shaft will remain in any position in which it is placed, without swinging one way or the other when the piston and rod assembly is allowed to hang from the pin.

Not only will this take the "galumph" out of your engine, it will make it possible to obtain steadier operation with the light high-speed props you'll be using.

Opening up intake and exhaust ports is a good way of getting more speed and power, better cooling, and higher operating efficiency. BUT it is also a way to make a motor hard to start, difficult to adjust and erratic to operate. There is a good rule of thumb for exhaust port area: the area of the exhaust port in sq. in. should not exceed one third of the displacement in cu. in. For example, if the engine has a displacement of .57 cu. in., the exhaust port area should not be increased beyond .19 sq. in. It is possible to find some modern racing engines which use considerably more area than this, but for old reworks the rule is adequate.

Finding the area of the present ports may be done by wrapping a piece of paper around a dowel, inserting it in the cylinder and tracing the outlines of the port(s) with a sharp pencil. When the paper is removed and flattened, the area can be measured with a scale and the proposed increase sketched in. An important thing to remember when filing out exhaust ports is that very seldom should the area be increased *upward*. To do so, in most cases, merely reduces the effective compression ratio with a resultant loss of power (which may show up as no gain when the over-all area is enlarged). Look for places where the area may be in-

creased "strategically." For example, if the top of the piston is somewhat below the lower edge of the exhaust port at the bottom of the stroke, remove this port metal first. Round ports may be squared off and webs may be removed in some places from smooth-piston engines. However, the cylinder should not be cut away for more than one third of the circumference at any one point, and *NEVER* remove the web between the ports of a ringed-piston engine.

The intake port comes next. This is usually more difficult to get at, but if one has a hand grinder the job is usually possible, and even with files and patience a good job can be done on many motors. Often the by-pass can be enlarged by 50% or more without weakening the metal to any extent, this being particularly true of engines with a removable by-pass cover such as the *G.H.Q.* Piston by-pass holes may be squared off with no bad result, but if there is any considerable web here, leave it in place. Buffing the by-pass is another small attention that will add to the performance. Great caution should be exercised in enlarging the transfer port into the cylinder. Remember that the exhaust port must open *first*. Not only because of the great pressure differential between the exploded gases in the cylinder and the raw vapor in the case, but in order to take advantage of resonance effect, i.e. the outward rush of the exhaust gases creating a momentary suction in the cylinder which assists in drawing in a fresh charge.

(Lacking mathematical substantiation for this theory, we are inclined to believe that the graph "peaks" at that point where resonance is operating most ideally, since although most engines will run faster than their peak, they will not, of course, develop any more power.)

Attention too, must be paid to the size and shape of the piston baffle when enlarging the transfer port. This port should not extend in a lateral direction to such an extent that fuel vapor blows out of the exhaust port along with burned gases.

The size and shape of the carburetor intake tube can be found only by experimentation. If the tube is too large, there will not be enough suction to draw in fuel, and if too small, the engine cannot reach its best speed. Sometimes the tube can be bored out, sometimes replaced. If it becomes oversized in rework, it can be brought back down by inserting another tube inside it, or by bending a scrap of metal and affixing it to the needle valve body. An air throttle or choke can be added to obtain very fine operational adjustments.

Intake porting includes another factor, the degree of opening and closing of the ports. Generally speaking, the intake port should not open into the case until 60 or more degrees past bottom center. How long it remains open after top dead center depends upon the type of porting employed and the intended speed of the engine. For the type of work we're doing it should not be open more than 40° past top dead center. Three port engines will have the same degree of opening before and after top center, but any rotary valve arrangement permits variation one way or the other. Some of the older engines use a flutter valve which operates solely on alternate suction and pressure in the crankcase and in this case, unless the gadget is removed and some other intake method used, it is better to leave the system alone.

There is a system of intake layout which often can be used to good effect on old three port (so-called sideport) engines. This is known as "skirt porting" and was employed on three commercial engines *(Howler, Bond, Rogers 29.)* With this system of porting additional air is inducted, either through the same port which serves for the exhaust outlet, or by means of an auxiliary port; in any case the extra air enters beneath the piston skirt when the piston is at the top of its stroke. There are many advantages to this system, the chief of which is large volume induction with good crankcase suction. When utilizing this porting system, there are several approaches to carburetion: the fuel may be fed in separately as in the *Howler;* by means of a small conventional intake tube as in the *Bond;* or the skirt port may be merely auxiliary, as in the *Rogers 29.* When converting a three-port engine to run in this fashion, make certain that the fuel intake opens first. The needle valve setting will be much richer, or, if desired—and it sometimes produces better results—the original intake tube can be plugged. Note: in some engines such as the Ohlsson three-port series, that skirt porting may destroy intake suction, if the intake port happens to come just under the exhaust port. In this case holes can be drilled some place else, and the piston skirt need not be cut away.

(Part 2, concluding this article, will appear in the September issue.)

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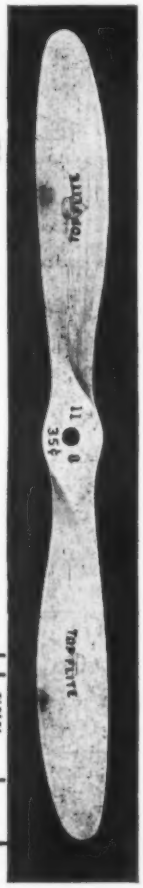


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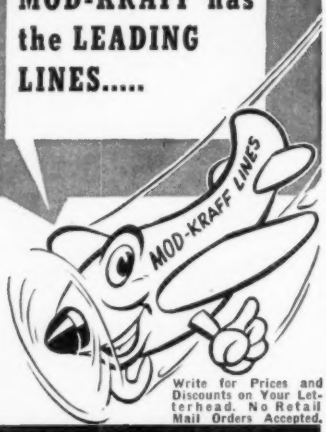


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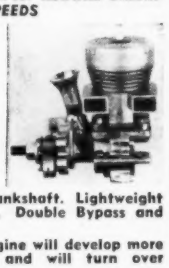

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## Radio Control "DeLuxe"

(*Continued from page 21*)

ings for the model. The result is usually a first-flight failure. Extensive changes in the fore-and-aft location of the motor, size of tail surfaces, dihedral, etc., do not always produce a successful flying model and even those rare successes do not duplicate the full scale ship in take-off, flight and landing attitudes.

This difficulty arises from the fact that the weight of the model structure is not distributed throughout the airplane dimensions exactly as in the full-scale airplane. And so it was that one of the first problems in dynamic model testing by Consolidated Vultee Aircraft Corporation was the reproduction of the exact mass distribution of the aircraft design being examined. Even this widely-experienced organization was unable to duplicate this distribution accurately and after completion of the model found it necessary to distribute 22 lb. of lead ballast throughout the structure to reproduce the desired pitching moment of inertia of the projected airplane.

On its first attempt to conduct dynamic model testing, Convair was in the fortunate position of already having built and flown the full scale airplane, the Convair Model 31, Navy XP4Y-1. However, the model was designed and built to test several projected design changes, including the substitution of a single vertical tail surface for the twin tails used on the prototype.

The model was built of balsa with 1/8" plywood bulkheads and 1/10" planking. The exterior of the model was stripped with rice tissue paper laid in shellac, which sealed the porous balsa and provided a water tight structure for operation in water. The model was given three coats of spar varnish for extra protection.

The problem of "scale power" was a difficult one and Convair called on our old friends, Ohlsson and Rice, to produce a 1.5 hp, two-cylinder, two-cycle model engine. This engine is rated at 1.6 hp at 4250 rpm and weighs 3.5 pounds. It has a displacement of 2.77 cu. in. and a width of 9.5" over the spark plugs in the horizontally-opposed cylinders. Both cylinders fire simultaneously and a small direct-drive rotary impeller is fitted as a supercharger. The propellers were machined from 24ST and equipped for adjustable pitch.

Two of these engines were used in the XP4Y-1 model and four engines of a similar type but developing 2 hp each are mounted in the XP5Y-1 model. The latter drive four-blade, square-tipped propellers. Direct fuel injection is used and fuel is carried for about 30 min. flying.

With a dynamically similar powered scale model available for model test work the next problem is radio control and this is one of the most interesting features of the Convair program. Operation of the control surfaces on the model must also be as much to scale as practicable and thus it was impossible to use any two-position "bang-bang" type of radio control such as most of us are used to working with. First of all, Convair desired to control the ailerons, elevator, and rudder separately in order to duplicate the full scale aircraft. In addition, the flaps were controllable, the engines were throttled separately and the ignition system had a separate control. Thus, the XP4Y-1 had requirements for seven channels and the XYP5Y-1 nine channels. (This immediately takes these models out of the amateur class, at least as far as yours truly is concerned!)

In order to control the model realistically, the Convair transmitter is a full scale mockup of the pilot's compartment with seat, rudder pedals, control wheel, throttles, ignition switch and indicating instruments located on an instrument panel. This mockup is placed near the water's edge, the pilot takes his seat and the flight proceeds. Each of these controls is actually a variable resistor in an A.F. oscillator circuit. For example, as the wheel is pushed forward, the audio frequency of the elevator system is changed.

The transmitter is a four-stage, crystal-controlled unit with an output of 63 W. A single r-f carrier carries the seven audio frequencies. Navy security regulations do not permit mention of the carrier frequency but it is reasonably certain to be in the uhf region because of the released fact that the effective range of the transmitter is only 3500'. A major problem of such a system is created by the fact that since the positioning of any control is determined by the modulated amplitude of the corresponding audio frequency, an extremely sensitive automatic volume control system is an essential. In order to correct for the day-to-day drift in the synchronization of the equipment, trimming knobs are mounted on all channels to save the lengthy time required for trimming equipment not so equipped.

The receiver, mounted in the airplane, weighs only 12.5 lb. complete with waterproof dural case. The changes in modulation of the audio tone for any channel operates a relay. Actually, the relay equipment is two-stage, with the first stage a sensitive relay, operated as above, which, in turn, operates a power relay. Power is provided by B and C batteries plus two small 6-volt and two 2-volt storage batteries. These batteries are linked up into two 8-volt circuits, totaling 14 ampere-hour output. One of these circuits is for the engine ignition system, which is kept separate from the remainder of the control system.

The controls are operated by small Servo motors. Each Servo is a five-pole, split field electric motor driving a gear train which, upon rotating, pushes a gear rack out or in. Each of these Servos draws 1 A at 6 volts. Some indication of the power of these Servos is gained by the fact that they can exert 14 lb. before stalling! Each Servo is equipped with potential dividers that position the Servo in proportion to the modulated audio signal. This is, essentially, a potentiometer which balances the bridge circuit carrying the plate voltage. The Servo armature is equipped with magnetic braking, which minimizes overriding and hunting and provides a sensitivity of one part in 40, or less than 1° on most of the controls.

The special features contained in the Convair system are most easily described by outlining a typical test flight of the model. The model is started by a portable booster box containing batteries and leads connected to a switching panel. The model has a boost plug-in so that the model electrical system can be operated wholly from the ground supply. Each Servo actually has jack plugs so that it may be operated through leads from the ground booster box independently of the radio control system. The model is started by plugging in the booster to the throttle Servos. The throttles are manually controlled until the engine is adjusted for the flight and the warm-up period is completed. When the power lead is pulled, the batteries in the model are automatically connected. The model is then placed in the water, the radio

switch is turned on, and the pilot at the mockup cockpit takes control of the model.

The model is then taxied out to the take-off position, its engines revved-up and it begins its take-off run. It climbs and maneuvers at the will of the pilot. When the 3500' limit is exceeded, the maximum amplitude of the signal is gradually reduced with the aileron and rudder signals reducing last. As their signals are reduced, the model rolls over into a left turn and flies back into the range of the transmitter where full control is regained.

A small rate-sensitive gyro is mounted in the model to permit the pilot to make coordinated turns by the wheel alone. This gyro is engaged by a micro switch on the pilot's control wheels. While engaged, it will maintain the model at any stabilized attitude automatically since the rate gyro is sensitive only to the rate- of-change and not the change itself. This gyro controls the model's rudder and therefore the pilot's rudder is disengaged during the time the automatic pilot is operating. However, when it is desired to run high-speed water taxi tests, the pilot may control the rudder of the model by throwing a switch on his instrument panel.

During the flight, important test data are being recorded. The model carries an airspeed indicator, a clock with sweep second hand, a water speed indicator and a trim indicator grid. In addition, there is a transparent lens in the nose of the model. A motion picture camera is placed aft of this panel and facing forward so that a photographic record is made of the horizon as seen through the lens together with records of the instruments mentioned.

After landing the model is beached under its own power, making it possible for engineers to make a complete test flight without even getting their feet wet. The model is slowed down as it approaches the ramp by cutting some of the engines out altogether and intermittently cutting the ignition of the remainder. When a few feet from the ramp the ignition is cut altogether and the model floats up into its cradle. The film is then removed, developed and analyzed at the leisure of the engineers on the project.

The film method has shown shortcomings, however, and Convair has developed a much simpler method which uses a camera only on the beach. Broad black stripes are painted in the model and the camera follows the model in the water always keeping the horizon in the picture. By a system of descriptive geometry, engineers are then able to analyze the film and determine the angle of the model with the horizon regardless of whether it is coming towards or going away from the camera.

The principal interest of Convair in radio controlled dynamically similar models is in determining the take-off and landing characteristics of the seaplane on the water.

However, there remains little doubt that radio controlled landplanes could be used for the determination of handling characteristics, such as the stall, spin recovery, and dynamic stability as well as landing and take-off characteristics on runways.

Assuredly, like many other innovations in model building, radio controlled models have now graduated into the scientific field in the aircraft industry and modelers have made another contribution to aeronautical engineering.

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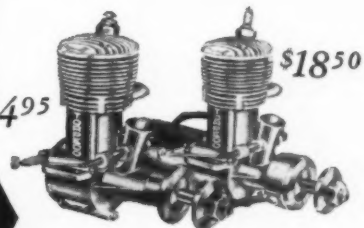


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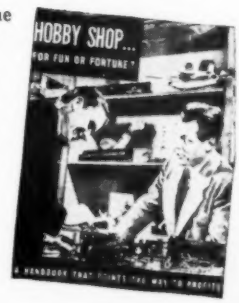


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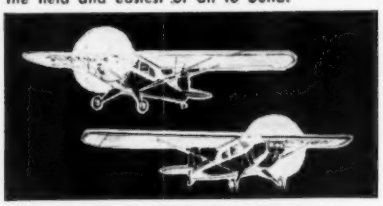

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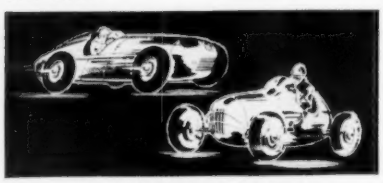

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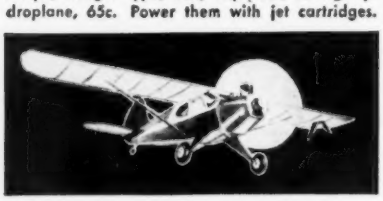

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Something new is cooking at Monogram! Watch for it in these pages next month.

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## Scrap Box

(*Continued from page 8*)

wants. Won't you publish these rules because the success of the event locally indicates it might be a shot in the arm for modeling all over the country?"—Herb's comments are as interesting as the rules. Talk on, Sahib.

"This event evolved from attempts at formation flying," explains Herb, "with two or more in the same circle. One day someone got the idea of putting paper streamers on the planes to make them look pretty and soon after that the fellows started making stabs at each others streamers. Combat resulted.

"At first we used only beat-up junk heaps but it soon became evident that the fellow with a little more speed and maneuverability had a definite advantage, so special combat ships were designed. Speeds peaked last spring at 110 mph but this proved a disadvantage for the ships moved too quickly for accurate passes. Since then we have dropped back to 90 mph and this seems about right. I am making a *Stuntwagon* which should be perfect."

The rules can't be reproduced verbatim, but we'll pass along the main points. Herb's address is 145 Coventry Pl., Fort Worth, Texas, if you are interested. Anyhoooo, it works this way. Two planes, fitted with 10' streamers, fly in the circle at the same time. The idea, of course, is to whittle the other guy's streamer with your prop without letting him return the courtesy. The ship landing with the longest streamer is the winner. Run on an elimination basis, the guy with the longest streamer after jousting ends for the day is the champ.

To start things rolling, three contestants are called for the first round. The instant they finish, two more are called. Lest that third man bother you, the first two to start their engines take to the air, the last man to start moving down the line to compete with the next two to fly. If he fails again to start quickly enough, he is eliminated from the contest. This gives every contestant two chances to start his engine.

Now, if, on the second round all three entrants start their engines simultaneously, the "move back" man is given first honor and he and the second chap have it out. The third man keeps his engine running until the other two have made at least four laps. If one ship force lands before four laps, the landing pilot becomes the "move back" man and the chap waiting on the ground then takes off to fight the ship in the air.

When a man is unable to start his engine, he is permitted to go on trying until the airborne ships complete four laps; the idea is that he might get started up in time to replace one that makes a forced landing before four laps. Lines are 65' from swivel to swivel for seniors and 60' for juniors and of .014 diameter. All lines are inspected for safety by the judges. If one plane crashes or lands after four laps the judges decide which pilot displayed superior ability and if one over zealous entrant chews up a rudder or causes a collision he is disqualified.

Charlie Douds, Englewood, N.J., having been chased by a controliner coming into the circle after him, passes along a tip about weighted wings. Inasmuch as we keep running into modelers who haven't heard of this idea, despite it being standard in some kits, we'll give Charlie exactly 13 sec. on the "*Soap Box.*" Sez he:

"I was asked after a crack-up if I had a weight in the wing. I had not heard of this one. This chap told me to balance the plane by the prop shaft and rudder bottom, when it should roll nearly vertical, outside wing low. Takes about one ounce in B and two in C. I note that ships that require little weight have generous rudder area. Apparently, there is a connection between torque and rudder area." Any comment?

Radio control enthusiasts may be interested in a sad experience survived by the Custodian of the "*Scrap Box.*" As you know, we had developed a nice-flying 6 sq. ft. job with Walt Schroder, equipped with rudder-only control, and powered by an *Ohlsson 60*. Whereas the experienced radio men advise maneuvering at the lowest possible speed, we frequently found ourselves zipping around in near verticals. While the snappy control response should permit some spectacular maneuvers, it turns out to have its drawbacks. On several occasions when the ship was permitted to nose up excessively in the climb, then put into a left turn, it refused to respond to further controlling and sailed off on a cross-country.

It so happened that we were telling Walt Good about the resistance of this airplane to downward spirals. In fact, we didn't believe that it would, and hence it would be unable to build up speed for loops and other maneuvers, to say nothing of the fact that it gained great altitude on long motor runs. This problem was not caused by power alone. Walt related how the big *Guff* "R.C." ship had resisted downward spirals when trimmed too light on the nose. In other words, a trim for a slow pretty glide has been found to be the trouble maker. Trimmed flat and fast, our model would respond perfectly to left or right, but nose light, a left turn in a climb would result in frequent loss of control due to torque overpowering the rudder. The moral of this, fellow beginners, is to be extremely careful about nose-light trims, particularly if fair speed is used. It is possible to lose a ship with the radio operating perfectly. Personally, we like relatively high speed maneuvering enough to push its development. But trim must be for fast glide, with landings definitely on the wheels for a two pointer.

For many moons C. O. Wright has been telling us about Carl ("Zipper") Goldberg's new free flight job and I must admit that I've been steamed up about it myself, since Carl is one modeler who knows design. Was this to be a kit? Well, hang out the flags, for here's a hot new free flight kit that's on the way. The tentative name is *Cumulus*, so we are informed, and the range of engines is from .19 to .36. He recommends a small additional flat center section for engines above .30.

Since we are approaching the end of the column and the Tall-But-True-Tales department we are reminded of our first RC flight (honestly the last time for the subject!). The transmitter had been going thump, thump, thump. Now everyone knows there are no moving parts, pistons, etc., inside a transmitter. We turned the black box over and looked under it. Then we put an ear against it and shook the thing. No dice. Suddenly we realized the thumping was in our own chest! Since we can't sneak the free subscription award for tall but true stories, let's dig into the story bin. And it is a bin, don't let anyone kid you. (Frank Zaic, you can't read this.)

"One calm June morning I was flying my *Thermic Floater*," says Norman something-or-other, from Winnipeg, Canada (nobody writes a legible last name!! "and on the third tow it caught a thermal, heading for high tension lines about 100 yards away. It got caught on the lines, balancing for about a minute or so until we knocked it loose with small stones. As it dropped it caught another thermal! This time it headed straight for a slow-moving freight, but landed on top of one of the box cars. By some unearthly means it started to fly again, caught up with the locomotive, finally coming down in front of the engine. C-R-A-S-H, no train . . . er, no model, I mean!"

Norm, that subscription is yours, hands down, for this month's event. Just supply your last name. "Sq---" ain't enough. And how about it fellows, letters are wonderful, but don't get engine failure when you scribble your John Hancock.

### PHOTO CREDITS

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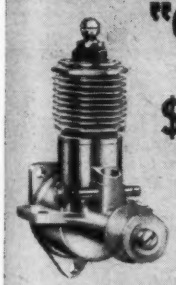

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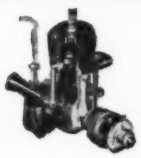

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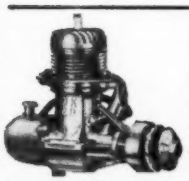

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## The Flying Flea

(*Continued from page 25*)

It will be necessary to join a couple of sheets of 1/16" for the rudder. Cut it to outline shape, sand carefully and then cover both sides with tissue or rubber model silkspan and set under a book or several magazines to prevent any warping until it is needed. Now would be a good time to cover the complete fuselage with tissue as this covering adds considerably to the strength and most certainly makes for a neater appearance.

All the wing ribs are cut from 1/16" sheet, 16 of R-1 and 4 each of R-2 and 3. Since this is basically a tandem, the ribs are identical for both wings. Taper the four spars as shown by the dotted lines on the drawings. Mark off the correct rib spacing on the rear span and slip all the ribs in place, but do not cement. Now place the main spar on the plan and cement the ribs to it, at the same time carefully aligning the ribs parallel with one another. After everything is lined up apply cement to each side of the ribs where the rear spar goes through. The leading edge may be glued to the nose of the ribs. Take a piece of 1/8" x 3/8" stock and taper from the bottom edge only, to match the reflex characteristics of the airfoil section, then cement in place.

Soak the uncovered wings under a hot water faucet for several minutes, then block up the tips 1-1/2" using weights over the center section and allow to dry overnight. When the weights are removed half of this dihedral effect will be lost. However, after the dope and covering are applied it will return.

Before covering, cement the two reinforcement blocks to the center of the spars on the forward wing only. Now get a piece of brass tubing 3/32" diameter and 3/8" long and bend a wire bracket to go through it and over the wing spar. Wrap this with thread; you see, all the lift is taken by this joint so do a good job of it.

Cover the wings with tissue or rubber model silkspan. When you spray the paper with water spray only the top surfaces; when these are dry, spray the bottom. This allows the top to dry and tighten first which creates the curved dihedral the same as in the prototype.

The tank shown is of the stunt type and is soldered up from .005 brass shim stock that can be obtained from any auto repair parts store. The mounting bracket can be of tin or brass and must be securely soldered to the completed tank.

Before final assembly is a good time to dope the model. The original has one brushed-on coat of clear dope and one of thinned filler. This was followed by 3 lightly sprayed coats of yellow dope. The trim is black dope which requires only one coat to cover. Of course it isn't necessary to paint the face in the front of your model but it is certainly worth the little extra work to give your model that finished touch. The license numerals are decals and go on the upper right and lower left panel of the forward wing. The numbers on the tail are first marked out lightly with pencil and then filled in with India ink or black dope.

Now for final assembly. Mount the motor using 3-56 machine screws, and be sure to slip the other wing mount brace and tank bracket over the screw. Since the real aircraft has its rear wing mounted atop the fuselage at a positive angle in relation to the thrust line, it stands to reason that this will lift the tail up into the air before the plane has enough forward speed for the top wing to be effective. I found this to be true from experience, so slip a few washers between the lower motor lugs and the motor mount until it is setting at an upthrust angle of 4 degrees.

Set the brass tubing wing hinge onto the two wire wing mounts, and heat with the soldering iron until the three units are fused together. Be careful not to touch the doped wing with the hot iron. Wrap this joint with soft iron wire and check to see that the wing is in correct alignment from the top and front views, then re-apply the soldering iron. Form the push rod that runs from the bellcrank to the top wing rear spar and connect so the wing shows about 10 degrees positive and 3 degrees negative incidence when operated by the bellcrank.

The rear wing is cemented directly onto the fuselage.

Nylon thread is recommended for the flying wires and straight pins formed into a small loop at one end serve as a means of securing the wires to the wings and to the nose. Short lengths of aluminum tubing are inserted through the fuselage and the thread passes through these.

One more detail must be attended to; that is the control hookup to the bellcrank. A guide is necessary as is shown in perspective on the plan. It extends 3" out from the side of the fuselage and is soldered to the wing mount and tank. 1/32" diam. wire is used for the lead outs from the bellcrank.

While constructing your model, be sure to check with the photos when in doubt about any of the details.

Remember when connecting your flying wires, for up-control the wing increases in angle, and it takes a negative attitude for down.


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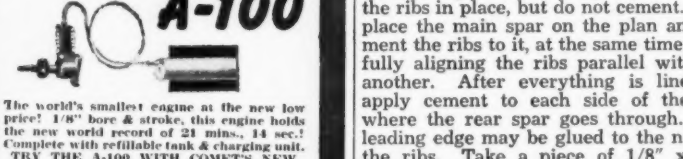

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## Report From the West

(*Continued from page 9*)

Robbers are still doing a great job for modeling on the West Coast and they should be congratulated.

Below is the list of winners of the 1st Annual U-control Model Airplane Contest, sponsored by the *Salinas Stardusters* and the Salinas Junior Chamber of Commerce, which took place May 8, at the Rodeo Grounds. Emory Steckler and William Phelphs were Contest Director and Chairman, respectively. *Sr.*—19 yrs. and over; *Jr.*—18 yrs. and younger; a special class was added for Jr.'s—12 yrs. and younger, called the *Freshman* Class. *Precision Sr. Class A*—John Lenderman 311 pts.; *B*—James Smith 323 pts.; *C*—Tom Van Dyke 361 pts.; *D*—Tom Van Dyke 383 pts. *Precision Jr. Class A*—Eugene Stiles 358 pts.; *B*—Eugene Stiles 284 pts.; *C*—Eugene Stiles 232 pts.; *D*—Donald Butman 351 pts.; *Freshman*—Dean Winters. *Speed Sr. Class A*—Herman Shiman 112.71; *B*—Malcolm Anderson 130.43; *C*—Herman Shiman 125.17; *D*—Bell Peden 125.61. *Speed Jr. Class A*—Mark Brown 109.75; *B*—Mark Brown 119.36; *C*—Mark Brown 119.20; *D*—Bill Angwin 113.13. *Women's Event Open*—Ilse Favor. *Novelty Event (Tied)*—Chet Hawoth and Neil Johnston. *Flying Scale Classes A & B*—James Smith 357 pts.; *C & D*—Robert Warner 294 pts. *Scale Speed Class B (24 laps)*—Les McBrayer. *Exhibition Scale*—James Smith. *180 Lap Race*—W. Biscay; *180 Lap Final Winner*—C. L. Bussard.

July 8, 9, and 10 are the days set aside for the *Southern California Plymouth Qualifying Meet.* The contest will be held in the Los Angeles area. Events will be the same as those in the 3rd International; however, some classes will be combined for purpose of award only.

A large contingent of West Coast modelers plan on making that trip to Olathe, Kansas, for the 1949 Nationals. Hope to see you there!

## Big Bird

(*Continued from page 11*)

inner wing panel at the proper dihedral and then fasten the two wing halves together. The tapered wing spars are then cut from sheet, inserted into each panel, marked, and cut to length.

Because of the unsupported ribs, care must be taken in inserting the spars. Slide the spars in on their sides and tilt upright only when they are in the correct position. After all the spars are in, glue on the remaining gussets and the upper and lower ribs to the spars. The dihedral ribs and center section sheet are then added. The leading and trailing edge are trimmed with a razor and then sanded. Care must be taken during sanding that the ribs are not thinned because this will weaken them considerably.

TAIL SURFACES. The elevator is constructed in the same general manner as the wing. The wing airfoil template is marked off for the portion used for the upper surface of the elevator rib. Strips of 1/16" sq. balsa are used for the lower half of the ribs. Strips of 1/16" x 1/8" balsa glued next to the proper ribs support the two sub-rudders which are of 1/16" sheet.

First glue the rudder frame together on the plans. After the glue is dry, the frame is raised and 1/16" sheet balsa blanks glued in for the ribs. The rudder is sanded to a streamline airfoil tapering from 3/8" thick at the base to 1/4" at the top rib.

PYLON. The pylon is first assembled as a frame containing the leading and trailing edges, pylon rib, and the 1/16" piano wire. After this assembly is thoroughly dry, the 1/16" sheet sides are glued on. The base of the pylon is trimmed to fit the fuselage. The proper incidence is then marked and the pylon top trimmed to fit the bottom of the wing. Give the pylon top a slight bit more dihedral than the wing itself, as this will allow the outside edges of the platform to contact the wing thus insuring a clean tight wing attachment. A wing saddle of 1/16" hard balsa sheet is cut to fit and glued to the top of the pylon.

PROPELLER. Every model builder has his own idea of the correct prop and power combination. Having done very little experimenting with big rubber jobs, I decided to play safe and cruise the model up, using a small prop. A motor of 22 strands of 1/4" brown rubber gave me a 1:20 motor run with 1200 winds, with the prop shown in the plans. This is the combination used at the 1948 Nationals.

The prop has a conventional folding device except that the hinges are soldered to a 5/16" wide tin band which is wound around the blade end. The hub is also reinforced with tin. For protection, cover the prop with silk and coat with 5 or 6 coats of dope. Each coat should be sanded down to insure a smooth finish. The nose block is of hard balsa, the grain running lengthwise. The block is tin-covered front and back to hold the thrust adjustment.

For simplicity a slack device using a compression spring on the front side of the prop was used.

ASSEMBLY. A 1/16" sheet fillet for the elevator is added to the rear of the fuselage. This fillet and the top longeron are trimmed to the contour of the elevator airfoil. The elevator is then papered, doped and glued on. The rudder is grooved at the base to fit the fuselage and matched to the top of the elevator. The


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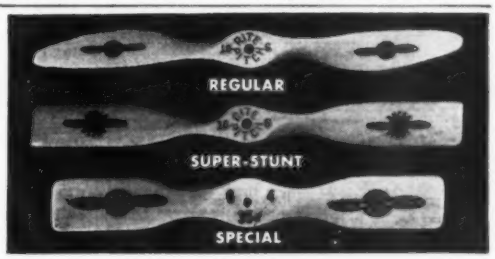


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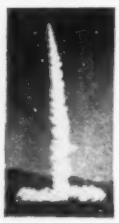

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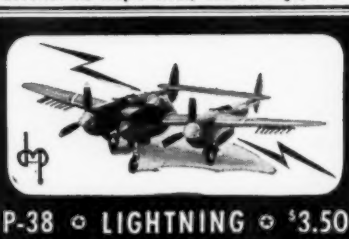

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rudder and sub-rudders are glued in place and papered. The rest of the model is then tissued, covered and doped. Single tissuing of Japanese paper is used throughout. The pylon is glued on and to check alignment, the wing is strapped temporarily to the pylon and the model is laid on the floor upside down. By measuring the distance of the elevator tips from the floor the surfaces can be aligned together perfectly. A 1/4" hole is made through the two horizontal longerons for the rear peg. A piece of 1/4" maple dowel is used for this peg and should project at least 1/8" out of each side of the fuselage for safety.

FLYING. The model is balanced 4" back from the leading edge, at the center of the wing. As this is also the center of the rubber motor, it allows various sizes and lengths of rubber to be tried without changing the C. G. location.

A right climb and left glide combination is used. The left inner wing panel is slightly washed-in and enough left rudder set in to turn the model in about 150' circles in the glide. Although the incidence given in the plans seems low, this amount coupled with the washed-in wing should give a very slight mush in the glide. The model should have a steady spiral climb and enough side thrust should be used to prevent mushing in the climb. Because of its size and angle to the ground, the cabin model ROG's with ease, as the first burst of power carries the model straight out and up.

The complete cabin weighed 13-1/2 oz. and the stick 12-1/2 oz. Both models flew alike, with the stick of course having a little better glide. The best results were obtained with 22 strands of 1/4" flat brown (T56) rubber, 53" long including slack. For maximum cruise, the rubber motor should be well broken-in before maximum winds are applied. At the Nationals the rubber motor used was a little over one year old. Castor oil was used as a lubricant.

Be sure and test hop the ship thoroughly before entering in a contest. With the C. G. of the motor and ship at the same spot the advantage of being able to change motors for wind conditions is yours. This design has proven to be a consistent flier and should provide good competition at any contest.

## Fitting Features

(*Continued from page* 31)

design is to minimize the tendency of the airplane to turn to the right when a bank to the left is initiated and *vice-versa*. (This tendency follows from the fact that a depressed aileron offers more drag than one raised the same angular amount.) In the type of aileron hinge shown in the accompanying drawing, the upward movement of an aileron projects that part ahead of the hinge line into the air moving past the lower surface of the wing and deflects some of this air through the slot between the aileron and the wing to the upper aileron surface thereby increasing the drag on the side of the airplane where the aileron is raised. In many control systems another device known as the "differential aileron" is used in conjunction with the balanced aileron. The differential arrangement simply permits, say, 10° of upward movement to be accompanied by only 7° of downward movement of the opposite aileron. This is usually accomplished in the design of the bellcrank. For example, (referring to the top view of the aileron mechanism in the drawings), if the two arms of the bellcrank comprised a right angle, the angular displacement of the up aileron and the down aileron would be identical. In the design shown, since the angle of the two arms exceeds a right angle, the upward travel will be greater than the downward travel occurring at the same time on the opposite aileron. Careful attention to design features of this sort are required, if you are really interested in accuracy and realism.

Every scale control system must incorporate some means of rigidly fastening metal parts to other metal parts as well as to wood parts. A brass control horn must be fastened to a wood spar, for example, or a brass aileron rocker arm to a tubular control stick support. Although metal fittings may be cemented to a wood structure, in scale model work this is not a safe practice since often the parts are inaccessible for repair after the model is completed. The use of small hard wood pins through holes drilled in the metal fitting plus a good quality cement is suggested. By this means the glue need be effective only on the wood. To fasten a piece of plate brass rigidly to a section of brass tubing is more difficult but can be accomplished satisfactorily by use of metal pins. Ordinarily these can be sections of wire 1/32", or smaller in diameter, the size being determined by the sizes of the material to be fastened together. The idea is to "force fit" the metal pin (slightly tapered) into a number 60 to number 70 hole drilled through the brass tubing and plate. The drawings of the elevator horn attachment to the elevator spar and aileron rocker arm to the control stick support illustrate this use of metal pins. The type of connection described should not offer any difficulty for the majority of modelers.

The control system shown in the sketches is about the simplest in principle that will be encountered. Other arrangements may involve additional linkage, torque tubes, or universal joints of various kinds, but in every system, however simple or complex, the lengths of the various lever arms (control horns, rocker arms, bellcrank arms, etc.,) should be held exactly to scale since these relative lengths determine the proper control surface movement for any given control stick displacement. Varying the lengths of the system's lever arms at random or to suit the builder's convenience can easily ruin any miniature system. (In the drawings of control linkage, no attempt has been made to relate the lengths of the lever arms to any particular angular travel of control surfaces or control stick since, as indicated previously, the system shown is to scale only with reference to the relative sizes of certain materials adaptable to scale model control systems.)

No mention has been made of rudder control systems because they rarely offer a problem. Nylon thread, or dental floss can substitute for aircraft cord or cable, while the rudder pedal arrangement can usually be built accurately to scale without modifications.

The altering of scale plans for any system or part can be justified only if it is impractical to construct the feature to scale and only if the scale inaccuracy does not detract from the over-all realism of the completed model. Under other circumstances, alteration is likely to be a policy detrimental to an otherwise effective model. The proposed scale deviations in control systems and rigging attachments are suggested primarily as a practical way of compromising rigid scale requirements with the degree of detail usually desired in this model type.

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## Audio Tone R.C.

(*Continued from page* 15)

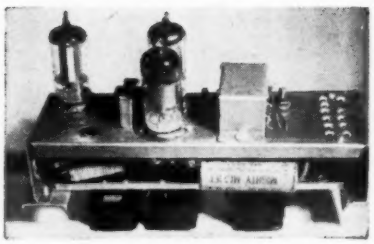
as the relay is held closed its signal contact will hold left rudder. When the tone is removed at the ground control, the reed stops vibrating, the relay drops to its back-contact, the opposite polarity battery is connected to the motor, which then runs back, moving the control arm to neutralize the rudder. When neutral is reached, the neutral limit switch opens the motor circuit and the rudder stops in neutral. Sounds complicated, but its operation is much more simple than the explanation. Of course, if another tone is sent from the ground, another relay operates and the rudder operates in the opposite direction in the same manner—but let's not go over *that* again!

The operation of this system is as follows: the transmitter or ground control is equipped to send out a modulated wave, which is similar to the signal sent out from broadcasting stations, but instead of containing voice or music, the wave contains only one particular pitch of tone at a time. The control equipment at the transmitter can select what pitch is desired, by means of switches in the operator's hand. Each tone will control a function of the airplane, and only that particular tone will do it. Thus, many forms of interference to the radio wave will have no bad effect on the plane's controls.

The fundamental idea employed for actuating the receiver may be applied to any of the various control systems which have been advanced in the form of "gadgets," and due to its ability to handle more than one control signal from the ground, will make possible the expansion of the utility of such arrangements. The improvement in the art offered by the equipment under discussion is in sensitivity and reliability. The receiver is so sensitive that it may be reliably operated by a transmitter only 5-1/2" x 6" x 6-1/2" in size, containing its own batteries, and to a distance of several miles if there are no intervening objects. This is fortunately the condition under which we operate when controlling model planes. Having more than one channel or selectable circuit makes possible the selection at will of the circuit desired, without going through a sequence of signals, and without having to operate controls one after the other in a certain order. For instance, right rudder may be repeated over and over with instant reaction, without proceeding through "right, neutral, left, neutral, right" and so on, every time it is desired to repeat a control. No matter what the last control was, any control may be executed at any time. All of these features have been brought out in a Patent Application now pending.

Fundamentally, a multi-channel system like this differs from the same number of channels of separate transmitters and receivers in that it is not practical to cause all of the various controls to operate simultaneously, unless a special arrangement is used. Sending a composite tone from the transmitter will operate the various reeds all right, but sending more than one tone at a time from the transmitter will reduce the loudness of each tone as it affects the receiver; the effective range of the equipment is thus reduced; more complicated modulating and mixing equipment is needed in the transmitter. Fig. 4 shows the simple transmitter and tone-generating circuit which is used. The key switch sets up conditions which determine what tone will be generated.

A more satisfactory way to accomplish simultaneous operation of controls if desired, is to equip the transmitter with what is called a *Synchronator*, which interrupts the tone controls from the control box and applies each tone to the transmitter in regular sequence, and in rapid succession, as they may be selected at the control box keys by the operator. This requires introduction of a slight time delay on each relay in the receiver to make it hold up solidly with the rapidly interrupted signal, and any or all of the relays may be operated at once, with full tone volume; thus full receiver sensitivity is had on each channel. The time delay introduced need not be enough to make it noticeable in controlling.



**Three-channel receiver used in 6' *Buzzard Bombshell*. Size is 1⅞" x 5½"; weight 11¾ oz. Circuit is shown in Fig. 2.**

A single-channel version of the receiver has been developed for the purpose of keeping weight down, as for use with such controls as the Owbridge-Rhodes *Rudevator*. Weighing about 6 oz., this receiver is less than 4" long and 2" wide, and operates with 4-1/2 oz. of "B" battery, with 3 to 4 pen cells for lighting the filaments. The tubes are good for about 1000 hr.; antenna adjustment of the receivers is not critical as to length, and there is no adjustment for sensitivity. All the receivers discussed will operate without attention or adjustment while the batteries hold out. As long as the signal received is above the minimum necessary to operate the receiver at all, the relays receive full current to operate them, no matter what the signal strength. The actual value of current available to operate the relays does not depend on the signal strength, and may be preadjusted to any value desired up to about 4 ma., by changing the value of the resistor in the reed filter shown in Fig. 2.

Considerable field experience has been rolled up, using both the single-channel and multi-channel systems; results have exceeded all expectations. Equipment given a slight touch-up of tuning adjustment at the beginning of a day has operated all day without further attention, and has at times been used for several days without readjustment. Control of a model has never been lost for even a moment due to any failure of a signal from the ground to reach the plane in the air, or even after landing again on the ground. At times a plane flying low, over the brow of a hill, has been controlled so as to make it reappear in sight. No more than 3 W. of power has ever been used in any transmitter, and less than 1 W. is normally used.

This equipment, the result of over ten years' development on the part of the author, is now available commercially and it is hoped will give an impetus to more wide-spread activity in the radio control field, which holds a great deal of enjoyment in store for all model plane fliers, whether interested merely in keeping a cherished model from getting away out of sight or in doing aerobatics and pylon-racing.

**Circuit Values**

*Figure 2*

L1—16 turns # 24 enam. wire on ¼" form (52 mc.)
L2—UTC type SO-5 subminiature audio choke
C1—.0001 mfd. Ceramicon
C2—3-30 mfd. trimmer
C3—5 micro-mfd. Ceramicon
C4—C5—.01 mfd. tubular
C6—.0005 mfd.
C7—.02 mfd. tubular
C8—.002 mfd.
C9—25 mfd.—30 volt electrolytic
C10—C11—C12—¼ mfd. paper
R1—1 Meg. ¼ watt
R2—5 Meg. ¼ watt
R3—3 Meg. ¼ watt
R4—1 Meg. ¼ watt
R5—2 Meg. ¼ watt
R6—1000 ohms ½ watt
Reed filter resistors—15,000 ohms
Relays—8,000 ohms

*Figure 4*

C1—20 mmfd. air trimmer condenser
C2—.0001 mfd. mica
C3—.01 tubular
C4—.03 tubular
T1—T2—Universal Output transformer—Merit A1300 or equivalent
R1—25,000 ohms ½ watt
R2—R3—R4—½ Megohm volume controls
L1—10 turns # 14 ½" I.D. spaced (for 52 mc.)
L2—1 turn # 14 ½" inside diameter
RFC—2.5 milhenry pie-wound universal choke

## Modeling Kinks

(*Continued from page 27*)

characteristic is that the washer falls off the plug and may be lost when the plug is removed from the engine. Spark plugs in the tool box are usually without a washer unless some means (such as a sleeve threaded on the plug) has been used to retain the washer.

An excellent remedy is to make your own spark plug washers from sheet aluminum about 1/32" thick. Variable condenser plates from an old radio are excellent for this purpose. Drill several holes in the plate about 1/64" undersize, relative to the outside diameter of the threaded part of the spark plug, and tap them. A satisfactory tap for aluminum can be made quickly from a cap screw having the same diameter and number of threads per inch as the spark plug. Merely saw a couple of slots across the threads as in Drawing D with a hack saw.

Cut the washer outline shape roughly to size with a pair of tin snips. Cut the head from the cap screw and thread the washers on the screw. Hold the screw in a drill press or lathe chuck, and rotate it, filing the peripheries of the washers until they are round and of the desired diameter. Then remove the washers from the screw and file the surfaces flat by dragging them across a flat file. This removes all burrs resulting from threading the holes and filing the peripheries.

You now have spark plug washers that can be threaded on your spark plugs so that they do not fall off when the spark plug is removed. They seal perfectly as aluminum is softer than copper. Aluminum washers also seal better than copper when the engine is hot because the coefficient of expansion of aluminum exceeds that of copper.

E—RUDDER MOUNT STIFFENER. Solid balsa rudders are usually mounted on balsa fuselages by merely cementing the two together. The anchorage is satisfactory until the rudder gets a little rough treatment when it is apt to break loose at the cemented joint. Stiffeners across the joint will be found a real improvement.

Pieces of razor blade are light yet stiff, and are easily installed. Using a pair of pliers or a vise, break the blade into diamond-shape pieces so the pointed ends will readily enter the balsa. Before cement is applied to the joint, bring the rudder and fuselage together with the stiffeners installed as in Drawing E. The stiffeners then act as aligning means when the joint is finally cemented together.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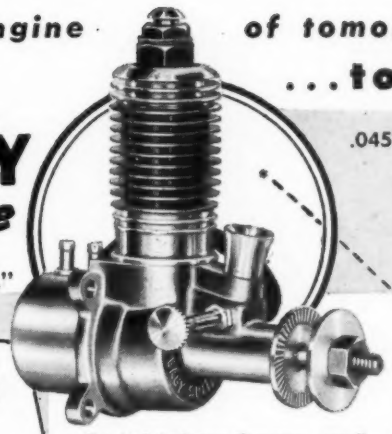

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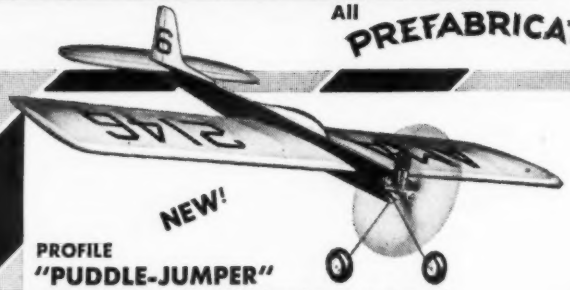

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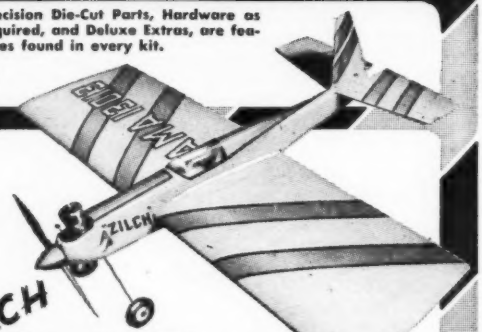

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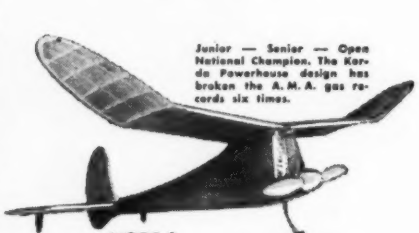

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**Crescent Service to Service Men is fastest in U. S. A.**

To make new customers and show appreciation to old ones, Crescent offers —for 30 days—a FREE PROP of desired size and pitch with each order for a new engine. You'll like doing business with Crescent because Crescent can supply those hard-to-get California items as well as all standard supplies. Crescent guarantees all merchandise, pays all postage if cash with order! You, too, will be a satisfied mail order saver once you discover Crescent's fast money-saving service.

**CATALOG**
**44 page catalog FREE with order Reg. 10c**

## CRESCENT RECOMMENDS

### Ignition Engines

| | |
|---|---|
| *O&R 29 | $13.95 |
| *O&R 60 | 11.95 |
| *O&R 60 Pak | 10.95 |
| *O&R 19 & 23 Std. | 9.95 |
| *O&R 19 & 23 RV | 10.95 |
| *McCoy 60 | 27.50 |
| *McCoy 49 | 25.00 |
| *McCoy 29 | 19.50 |
| *McCoy 19 | 10.95 |
| *Super Cyclone 60 | 12.95 |
| *Dooling 61 | 35.00 |
| *Spitfire 64 | 24.95 |
| *Orwick 64 | 27.50 |
| *Orwick 29 | 21.50 |
| *Fox 59 | 29.95 |
| *Super Champ 62 | 19.50 |
| *Triumph 51 | 20.00 |
| *Triumph 49 | 20.00 |
| *K&B Torpedo 29 | 18.50 |
| *K&B Torpedo 24 | 16.50 |
| Arden 099 PB | 12.50 |
| Arden 099 BB | 15.50 |
| Arden 199 | 18.50 |

### Glow Plug Engines

| | |
|---|---|
| *O&R 29 | 12.95 |
| *O&R 29 Pak | 11.95 |
| *O&R 19 & 23 RV | 9.95 |
| *O&R 19 & 23 RV Pak | 8.95 |
| *K&B Glo Torp 32 | 14.95 |
| *K&B Glo Torp 29 | 14.95 |
| *K&B "Infant" 02 | 7.95 |
| *Glo Devil 62 | 17.50 |
| *Triumph 49 | 18.00 |
| *Triumph 51 | 18.00 |
| *Sportsman Sr. 55 | 16.95 |
| *Sportsman Jr. 36 | 14.95 |
| *Sportsman 29 | 11.95 |
| *McCoy 19 | 9.95 |
| *McCoy 19 Race Car (with pinion gear) | 10.95 |
| *Thimble Drome 099 | 9.95 |
| *Thimble Drome 15 | 9.95 |
| *Thimble Drome 199 | 10.95 |
| *Baby Spitfire 045 | 7.95 |
| O.K. Cub 049 | 5.95 |

### Air Engines

| | |
|---|---|
| Campus A-100 w/tank | 5.95 |
| Campus Bee w/tank | 4.95 |
| O.K. C02 | 4.95 |

### Jetex Engines

| | |
|---|---|
| Jetex 350 | 12.50 |
| Jetex 200 | 8.50 |
| Jetex 100 | 4.95 |

### Control Line Kits

| | |
|---|---|
| *Joker (C) | 5.45 |
| *Casalaire (C) | 8.75 |
| *Madman, Sr. (C) | 18.00 |
| Super-Zilch (C) | 4.95 |
| A.J. Fireball (B-C) | 7.95 |
| Howard Pete (B-C) | 5.95 |
| Monocoupe (B-C) | 4.95 |
| Mr. Mulligan (B-C) | 4.95 |
| Sky Box Trainer (B-C) | 4.95 |
| Super Sky-Box (B-C) | 4.95 |
| Lil Duper Zilch (B) | 3.95 |
| *Go-Devil Jr. (B) | 4.95 |
| *Brave (B) | 3.95 |
| *Jester (B) | 3.95 |
| *Curtiss PI-A (B) | 9.00 |
| *Warrior (B) | 3.95 |
| *British SE-5 (B) | 4.95 |
| *Madman, Jr. (B) | 6.95 |
| Speedwagon 30 (B) | 3.95 |
| Stuntwagon 30 (B) | 4.95 |
| Nifty (B) | 4.95 |
| Trainee (B) | 3.95 |
| Tc 2 Trainer (B) | 2.95 |
| Lockheed Sirius (B) | 4.95 |
| New Era (B) | 3.95 |
| Stunt Ace (A-B-C) | 3.95 |
| Comet Pinto Cub (A-B-C) | 2.95 |
| Minnow (A-B) | 4.95 |
| Cessna 195 (A-B) | 4.95 |
| Piper Cub (A-B) | 4.95 |
| Aeronca Sedan (A-B) | 4.95 |
| Beechcraft (A-B) | 5.95 |
| Piper Vagabond (A-B) | 3.95 |
| Dynamic (A-B) | 3.50 |
| Glo-Bug (A-B) | 2.95 |
| Maverick (A-B) | 1.00 |
| *Jeepers (A-B) | 2.95 |
| *Invader (A) | 5.95 |
| *Fokker-Tripe (A) | 3.50 |
| Speedwagon 20 (A) | 3.95 |
| Super Fury (A) | 2.50 |
| Winnie Mae (A) | 2.95 |
| Whirlwind Jr. (A) | 2.95 |
| Super Solution (A) | 2.25 |
| Swee' Pea (A) | 2.50 |
| Howard "Ike" (A) | 2.95 |
| Buster (A) | 2.50 |
| Baby Sky Box (A) | 3.50 |
| Infant Wagon (02-09) | 1.75 |
| Baby TC-2 (02-09) | 1.98 |
| Baby New Era | 2.50 |

### Free Flight Kits

| | |
|---|---|
| Playboy Sr. (C) | 6.00 |
| Zoomer (C) | 3.95 |
| Playboy Jr. (B) | 3.25 |
| Zipper (B) | 5.95 |
| Powerhouse (B) | 4.95 |
| *Miss Tiny (A-B) | 3.65 |
| *Spook 48 (A-B) | 1.95 |
| Zipper (A) | 2.50 |
| Profile Powerhouse (02) | 1.00 |
| *Bambino (02) | .95 |
| *Civy Boy (02-05) | 1.35 |
| Cleve, Minnow (05) | 1.00 |

### Accessories

| | |
|---|---|
| U-Reely Control (new) | 8.50 |
| U-Reely Remoto | 12.50 |
| Metal Reel | 1.25 |
| Metal Handle | 1.00 |
| *Wood Reel 6" dia. | .50 |
| *Wood Handle | .50 |
| *2-52½' Stranded wire | 2.75 |
| *2-60' Stranded wire | 2.95 |
| *2-70' Stranded wire | 3.25 |
| *2-3' Lead Ins. | .40 |
| Spark Plugs (all sizes) | .50 |
| *O&R Glow Plug (V & V2) | .65 |
| *O&R Racing Plug (V & V2) | .65 |
| *Infant Glow Plug | .85 |
| *Spitfire Glow Plug | .85 |
| Arden Glow Plug | .85 |
| Champion Glow Plug | .75 |
| *Firecracker Coil | 2.75 |
| *Competitor Coil | 1.95 |
| Aero Ft. Wt. Coil | 2.50 |
| Aero Quality Coil | 3.00 |
| Aero Condenser | .35 |
| Metal Condenser | .30 |
| *Booster Plug & Socket | .50 |
| Toggle Switch | .50 |
| Slide Switch | .25 |
| Neoprene Tubing 3/16" O.D. Ft. | .20 |
| 1/4" O.D. Ft. | .20 |
| Ignition Wire Ft. | .03 |
| Silkspan 00 | .05 |
| Silkspan GM | .10 |
| Wet Strength Tissue—Red, Yellow, Blue Sheet | .10 |
| Jap Tissue (White) | .10 |
| Elmic Timer | 2.50 |
| *Austin Timer | 1.50 |
| *Baby Timer | 1.50 |
| *Flex Needle Valve | 1.00 |
| Universal Needle Valve | .50 |
| *Battery Box (all sizes) | .40 |
| *Lucite 4-pencell B. Box | .75 |
| *Bell Crank (Lg.-Sm.) | .25 |
| *O&R 60 Metal Fuel Tank | 1.75 |
| *O&R 23 & 19 Fuel Tank | 1.50 |
| *Master Stunt Tank (Med.) | 1.25 |
| *Macco Stunt Tank | 1.25 |
| *Baker Wedge Tank (Lg. Med. Small) | 1.25 |
| *Baker Tiny Tank (K.D.) | .35 |
| *Mart-Lee Mufflers: Class A (4") | 1.95 |
| Class A & B (5") | 2.95 |
| Class C & D (9") | 2.95 |
| Class B-C-D (5½") | 2.95 |
| *Counter Balance (B&C) | 1.50 |
| *I-blade Prop (B & C) | .50 |
| *Baby Spitfire Props: Free Flight | .35 |
| U-Control | .35 |
| "Infant" Power Prop | .25 |
| *O&R 60 Rotary Valve | 6.00 |
| *O&R 23 Rotary Valve | 5.00 |
| *4-way plug wrench | .50 |
| *Austin Glue Gun | .75 |
| *Austin Fuel Can | .75 |
| *Turbo Fuel Pump | .69 |
| *Hap-The Pilot | .95 |
| *Veco Wheels (Pr.): Airwheels— 2½" $2.50, 3½" $3.00, 4½" $3.50. | |
| Semi-pneumatic — 2" 85c, 2½" $1.00, 3" $1.50. | |
| Streamline—1⅞" 45c, 2⅜" 60c. | |
| Balloon Spongewheel: 7/8" 20c, 1" 25c, 1⅛" 25c, 1¼" 30c, 1⅜" 30c, 1½" 35c. | |
| ¼" English Rubber @ 2½c ft. | |

### Tools

| | |
|---|---|
| Moto-Sander & Polisher | 14.85 |
| Dremel Moto-Tool ☐2 | 23.50 |
| Dremel Moto-Tool ☐1 | 17.50 |
| Dremel Moto-Saw | 5.85 |
| X-acto Chest ☐86 | 10.00 |
| X-acto Chest ☐87 | 15.00 |
| Hobby Hand Drill | 1.25 |
| *Ungar Soldering Kit | 2.25 |

### Gas-Powered Boat Kits

| | |
|---|---|
| Vinyard Sedan Cruiser | 5.50 |
| Harco Cruiser 25" | 5.50 |
| Chris Craft 26" | 5.50 |
| Chris Craft Express | 5.50 |
| Chris Craft Runabout | 5.50 |
| Owens Flagship 26" | 5.50 |
| Dumas Elec. Drive Unit | 4.00 |
| Buckeye Speedboat | 4.95 |
| Elco Cruiser | 4.95 |

### Misc. Boat Kits

| | |
|---|---|
| Schooner Bluenose 22" | 3.75 |
| Sov. of Seas 23" | 3.75 |
| Cutty Sark 24" | 3.75 |
| Tug Boat 14½" | 3.75 |
| Destroyer Preston 24" | 4.50 |
| Coast Guard Campbell 22" | 4.50 |
| Rev. Cutter Hamilton 22" | 4.50 |
| Privateer Rambler 23½" | 4.50 |
| Oil Tanker 20½" | 4.50 |
| Constitution 22" | 6.00 |
| USS Kearsarge 32" | 9.00 |
| Flying Cloud | 9.00 |
| Marion Sprague 29" | 9.00 |
| Santa Maria | 15.00 |
| Viking | 9.00 |
| PT-10 | 6.00 |
| Gertrude Thebaud | 14.25 |
| Elco Cruisette 27" | 12.00 |
| Queen Eliz. w/elec. motor | 4.95 |

### Racers

| | |
|---|---|
| *Thimble Drome w/engine: Lightning Bug 199 | 21.50 |
| DeLuxe Chrome Plated | 25.00 |
| Champion 15 | 19.95 |
| DeLuxe Chrome Plated | 23.50 |
| Doodle Bug .099 | $19.95 |
| DeLuxe Chrome Plated | 23.50 |
| Champion Tether Model | 3.95 |
| T.D. Geared Drive Unit | 3.95 |
| Adapter for Drive Unit | 1.95 |
| Challenger, Jr. | 3.95 |

### Misc. Kits

| | |
|---|---|
| 1909 Model T Ford | 2.95 |
| 1910 Model T Ford | 2.50 |
| 1911 Maxwell | 2.50 |
| Oldsmobile | 1.95 |
| Stanley Steamer | 2.95 |
| Amoskeag Steamer | 6.50 |
| Clipper Clock | 6.50 |
| *Horseless Carriage | $ 1.50 |
| *Surrey w/fringe on top | 1.75 |
| *Victoria w/calash top | 2.35 |
| *Covered Wagon | 3.95 |
| *Stage Coach | 3.95 |
| *Mexican Ox Cart | 2.25 |
| *Sportsman Convertible | 1.00 |
| *AVB Hot Rod | 1.00 |
| *JVB Hot Rod | .85 |
| *Jeepster | 1.00 |
| *DeLuxe Midget Racer | 1.50 |
| *Wishing Well | 1.95 |
| Hawk F-84 (plastic) | 1.00 |
| *B0C Shoot. Star (plastic) | 1.00 |

*Means California Merchandise.

## CRESCENT PICK-OF-THE-MONTH

**ANDERSON**

# BABY SPITFIRE

*"First in Its Class"*

Contains every modern feature for economical hi-speed operation of the new small-class ships. Beginners and experts will both like the "Baby Spitfire" because it's easy to start and has what it takes. Dural and hardened alloy steel. Displacement .045 cu. in. Wt. 1 oz. (less plug).

**Complete with PLUG TANK and FREE PROP**

**$7.95**

## *Spotlight on Civy Boy 31*

The new free flight model that many fans on the West Coast are using. Specially designed for "Baby Spitfire" (above), small diesels and Herkimer CO² and mfd. by Austin-Craft. An exact miniature replica of Paul Gilliam's Class C AMA record holder, Civy Boy 74.

**$1.65**

Wing area 155 sq. in. Easy to assemble.

**BOYS: You Can EARN MONEY**

In the Model Business if you live in a community where there are no dealers. Be a Crescent "Junior Dealer". Sell model supplies to your friends and neighbors —and get yours FREE. Ask for details.

**HOW TO ORDER PREPAID.** Send remittance in full and we will pay postage, insurance, and handling. Minimum order $1.00. California residents please include 2½% Sales Tax. C.O.D. Send just $1.00 and we will ship collect same day. SERVICE MEN. "Special Handling" without charge on prepaid A.P.O. and F.P.O. orders. 15 cents postage on all orders under $2.00 in U.S.A.

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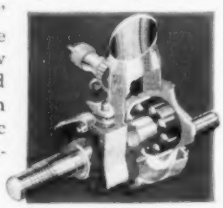
**5620 West Pico Blvd., Los Angeles 35, Calif.**

Finest of All
FOR ALL
FOUR EVENTS
TEAM RACING. Less time in the pit with O & R Soup-OR-Puck and "29" easy starting.
"PAA-LOAD" Increase your chances of sharing in $4,670 prizes with hi-torque, light weight O & R 29.
Ohlsson & Rice
29
FREE FLIGHT. Maximum displ. for Class B — .299 cu. in. O & R dependability. Adjustomatic Timer.
U-CONTROL. Endurance for heavy duty operation with the "29" rollerized main bearing!

It's the leader in *more* than looks, in *more* than features —the All-New O & R 29 is the finest model engine in the world because with it a modeler can *do more* than with any other model engine ever built. *Hi-torque* and *lightweight* — for payload and free flight use, *rollerized*–for the punishing grind of U-Control, *easy starting* and *fuel thrifty* for team racing and all-purpose sport flying! And with .299 cu. in. displacement, the "29" is maximum-powered for Class B. If you haven't got yours yet, "take off" for a new model experience today. Order a polished-precision "29" in your favorite form — Glow Plug, Standard Ignition with Adjustomatic Timer or Engine Pak at your Dealer's.



*FREE — O & R Eagle decals for your ship.*

**O&R 29 Engine Pak . . . $11.95**
includes O & R Racing Glow Plug

**O&R 29 Glow Plug Engine $12.95**
includes O & R Racing Glow Plug

**O&R 29 Ignition Engine . $13.95**
includes Champion Spark Plug and O & R Adjustomatic Timer

P.S. — Watch for new finest O & R Pow-OR-Pitch Props at your dealer's. More sizes — more pitches — more power . . . Just **35¢** each

*If not available locally, address the factory*

**Ohlsson & Rice**
*Standard of the Model World*

Emery at Grande Vista
Los Angeles 23, California

**Manufacturers of Pow-OR-Team: Engines, Engine Paks, Fuels, Glow Plugs and Propellers**